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ANTHROPOMETRY OF THE HAND.

by

10 Robert M. White

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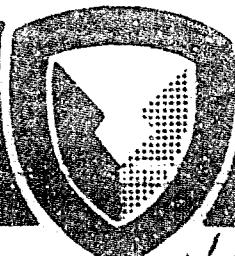
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ANTHROPOLOGY ANTHROPOMETRY SURVEY(S) DATA	ARMED FORCES U.S. ARMY MILITARY PERSONNEL MEN	WOMEN HAND(S) HANDWEAR MILITARY CLOTHING	SIZES (DIMENSIONS) MEASUREMENT(S) BIBLIOGRAPHY
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<p>Comparative anthropometric data on the human hand are presented and discussed in detail in this technical report. Since reliable and definitive data on the hands of the U.S. civilian population are lacking, anthropometric data on the hands of the U.S. military population of men and women may be utilized in analyses of handwear sizing.</p> <p>Data are presented for ten hand measurements: Hand Length, Palm Length, Thumb Crotch</p>			

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20. Abstract (cont'd)

Length, Hand Breadth, Hand Breadth at Thumb, Hand Circumference, Hand Circumference at Thumb, Fist Circumference, Wrist Circumference, and Hand Thickness. These hand measurements are defined and illustrated.

Detailed anthropometric data on the hands of U.S. Army men and women are presented in the form of bivariate tables which depict the distribution of various categories of hand sizes, and show the interrelationships among hand dimensions.

Selected anthropometric data on the hands also are presented for a variety of foreign military populations in order to illustrate the range of variation in hand size to be found in different parts of the world.

In the final section, hands and handwear are examined in terms of the sizing of handwear, and the development of tariffs for handwear is explained with illustrative examples.

An extensive bibliography concludes the report.

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## SUMMARY

Comparative anthropometric data on the human hand are presented and discussed in detail in this technical report. Since reliable and definitive data on the hands of the U.S. civilian population are lacking, anthropometric data on the hands of the U.S. military population of men and women may be utilized in analyses of handwear sizing.

Data are presented for ten hand measurements: Hand Length, Palm Length, Thumb Crotch Length, Hand Breadth, Hand Breadth at Thumb, Hand Circumference, Hand Circumference at Thumb, Fist Circumference, Wrist Circumference, and Hand Thickness. These hand measurements are defined and illustrated.

Detailed anthropometric data on the hands of U.S. Army men and women are presented in the form of bivariate tables which depict the distribution of various categories of hand sizes and show the interrelationships among hand dimensions.

Selected anthropometric data on the hand also are presented for a variety of foreign military populations in order to illustrate the range of variation in hand size to be found in different parts of the world.

In the final section, hands and handwear are examined in terms of the sizing of handwear. A listing of standard U.S. Army handwear items is presented and the problems of sizing in these types of handwear are discussed. The sizing of handwear is based primarily on the circumference or girth of the hand. The unit of measurement used in the glove industry for the sizing of handwear is not the English inch, but is the French or glovers' inch, which is equivalent to 27.0 millimeters. The development of tariffs for handwear is explained, with illustrative examples showing tariffs of handwear for U.S. Army men, for U.S. Army women, and a combined tariff for both U.S. Army men and women.

An extensive bibliography concludes the report.

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## COMPARATIVE ANTHROPOMETRY OF THE HAND

### 1. INTRODUCTION

One of the most significant developments during the long period of early human evolution was man's achievement of upright posture, since this freed the hands for activities other than locomotion. Ever since that time, the human hand has been one of the most important parts of the body. The tremendous value of the human hand as a functional device for grasping, manipulating, and writing, as well as other activities, need not be emphasized.

The dimensions or sizes of the human hand are important for two primary reasons: protection and function. Since the hands (together with the feet) represent the extremities of the body, they require protection from heat to some extent, but particularly from cold. Obviously a considerable range of protective handwear is available, from the very thin gloves of the surgeon to very heavy gloves or mittens insulated against the cold. Regardless of the type of handwear, however, dimensional information on the hands to be fitted is required for the effective sizing of handwear.

The sizes or dimensions of hands also are important in any consideration of hand function. Handles of tools or implements to be grasped with the hands as well as handles for lifting or knobs for turning, must be suitably sized. The effective sizing of handles to be grasped, or the sizes of openings through which the hand may be inserted, are further complicated if a gloved or protected hand is to be considered. It is apparent, therefore, that information on the range of variation in the sizes and dimensions of the human hand comprises a very important part of the basic knowledge of the human body represented by anthropometric data.

In spite of the importance of the human hand and the need for data on the dimensions of the hand, it is unfortunate that very little reliable and definitive information is available on the hands of men and women in the adult civilian population of the United States.

Only a few anthropometric surveys of civilians have been carried out in the United States. A survey of U.S. civilian women was conducted in 1939-1940 by the Bureau of Home Economics, U.S. Department of Agriculture. In that project, 59 body measurements were taken on almost 15,000 women, primarily for application in pattern and garment construction. However, no hand measurements were taken. A limited number of body measurements were taken during a national Health Examination Survey (HES) of U.S. civilian men and women, carried out between 1959 and 1962 by the Public Health Service, U.S. Department of Health, Education, and Welfare (HEW). In this survey, covering individuals between 18 and 79 years of age, 3,091 men and 3,581 women were measured. Anthropometric data were obtained for 18 body measurements, but no hand measurements were made. A more recent Health and Nutrition Examination Survey (NHANES) was conducted by the U.S. Department of Health, Education, and Welfare between 1971 and 1974 in which 20,749 persons between the ages of 1 and 74 years were examined. Again, however, no hand measurements were made.

A few anthropometric surveys of specialized samples of the U.S. adult population have been carried out, but even in some of these studies, hand measurements were not included. In only four of these studies were hand measurements taken. Hand measurements were taken in an anthropometric study of 130 Spanish-American War veterans, carried out in 1959 by Damon and Stoudt.<sup>1</sup> Damon and Stoudt also participated in the initiation of a normative aging study of U.S. male veterans, being conducted by the Boston Outpatient Clinic of the Veterans Administration (VA).<sup>2</sup> This project was started in 1972 and is continuing; hand measurements are included in the measurements being taken. A more recent anthropometric survey of U.S. civilian men was carried out in 1974, when personnel of the Naval Electronics Laboratory Center in San Diego, California, measured a national sampling of approximately 3,000 law enforcement officers.<sup>3</sup> This survey, which was performed under contract for the Law Enforcement Standards Laboratory of the National Bureau of Standards, included hand measurements.

The only recent survey of U.S. civilian women was carried out in 1971 by the Federal Aviation Administration's Civil Aeromedical Institute in Oklahoma City, Oklahoma.<sup>4</sup> In this study, 72 body measurements were made on 422 airline stewardess trainees, and hand measurements were included.

In contrast to the paucity of data on hands in the civilian population of the United States, a great deal of anthropometric data on hands is available for the military population of U.S. men and women. Many anthropometric surveys of military personnel have been carried out since World War II, and most of these surveys have included at least some hand measurements. The lack of data on civilian hands in effect forces the designer or human engineer into the use of military data on hands; there is simply no alternative.

It is the primary purpose of this report to present available anthropometric data on the hands of men and women in the U.S. military population.

<sup>1</sup>Damon, A., and H. W. Stoudt. The Functional Anthropometry of Old Men. *Human Factors*, Vol. 5, No. 5, 485-491, October 1963.

<sup>2</sup>Damon, A., C. C. Seltzer, H. W. Stoudt, and B. Bell. Age and Physique in Healthy White Veterans at Boston. *Journal of Gerontology*, Vol. 27, No. 2, 202-208, 1972.

<sup>3</sup>Martin, J. I., R. Sabeh, L. L. Driver, T. D. Lowe, R. W. Hintze, and P. A. C. Peters. Anthropometry of Law Enforcement Officers. Technical Document 442, Naval Electronics Laboratory Center, San Diego, California, September 1975. (AD A017 066)

<sup>4</sup>Snow, C. C., H. M. Reynolds, and M. A. Allgood. Anthropometry of Airline Stewardesses. Report No. FAA-AM-75-2, Federal Aviation Administration, Civil Aeromedical Institute, Oklahoma City, Oklahoma, March 1975.

## 2. A REVIEW OF SOME LITERATURE ON THE HAND

Data and information on the hands of U.S. military personnel may be found in several studies carried out between 1956 and 1970. The results of most of these studies were published in U.S. Air Force technical reports. These references will be reviewed and summarized in this section.

An early example of the collection and analysis of anthropometric data on hands was presented in a report by Barter and Alexander (1956).<sup>5</sup> A selected sample of 100 hands was measured and data for 31 hand dimensions were presented in this report for design purposes. The data were given in the form of summary statistics, regression equations, design dimensions, and procurement tariffs for gloves. Two techniques were utilized in collecting the hand data. In the first, standardized anthropometric measurements of the hand were taken, as well as some new measurements especially designed for this study. The second technique involved taking a roentgenogram of both outstretched hands. The report also presented the rationale for and procedures followed in the development of a sizing system for high altitude gloves. The program was based on four divisions of hand circumference, each further subdivided into three divisions of hand length, making a total of twelve sizes of gloves. Subsequent fit-testing indicated that a high percentage of personnel could be fitted adequately in their indicated size.

Detailed analyses of anthropometric data on the hand were presented in a report by Churchill, Kuby, and Daniels (1957).<sup>6</sup> The basic data used for men were those obtained in a survey of 4063 USAF flying personnel in 1950, while the data on women were obtained in a survey of 852 WAF basic trainees in 1952. Dimensional data for the hands of both male and female USAF personnel were summarized in tabular and graphic form. The interrelationships within each of the two groups of dimensions were given in the form of tables of correlation coefficients. A series of tables showed estimates of the other dimensions for the appropriate ranges of values of hand length, hand breadths at metacarpale and at the thumb, and fist circumference. Nomographic charts were presented for estimating the related dimensions for all likely combinations of values of hand lengths and breadths for both USAF men and women. Data from other surveys of military personnel were summarized; these data suggested the applicability of the tables and charts presented to the design of handwear intended for almost any group of U.S. Air Force personnel.

<sup>5</sup>Barter, J. T., and M. Alexander. A Sizing System for High Altitude Gloves. WADC Technical Report 56-599, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, December 1956. (AD 110 589)

<sup>6</sup>Churchill, E., A. Kuby, and G. S. Daniels. Nomograph of the Hand and Its Related Dimensions. WADC Technical Report, 57-198, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, April 1957. (AD 118 162)

In a report by Jones, Kobrick, and Gaydos (1958),<sup>7</sup> available data on the hand at that time were summarized. Descriptive data were presented on the structural and functional characteristics of the human hand which are of interest to human engineers concerned with the design of handwear and manually-operated equipment. The first section of the report dealt with the anthropometric dimensions of the hand and showed the percentile distribution of hand sizes in several military population samples. The second section reviewed data on the biomechanics of the hand in terms of direction, range, and forces involved in typical functional movements.

A comprehensive descriptive summary of the X-ray anthropometry of the hand was presented in a report by Vicinus (1962).<sup>8</sup> The 253 subjects chosen for measurement were selected to be representative of the U.S. Air Force population in hand length and hand breadth. Summary statistics for 24 lengths and 20 breadths for both right and left hands were presented. Also included in the report were complete intercorrelation matrices for both hands, indicating the degree of relationship between the 44 hand dimensions. Analysis of the data indicated that, in general, the right hand tends to be longer and broader than the left; the right hand also showed slightly greater variability in length and less variability in breadth than the left. The lowest correlations occur in the relationship between length and breadth dimensions, and the highest are to be found within the length dimensions of each of the five digits.

A report by Garrett (1970)<sup>9</sup> describes 56 anthropometric dimensions measured on the hands of 211 U.S. Air Force female personnel, including Women in the Air Force (WAF), Nurse Corps, and Biomedical Science Corps, aged 18-56 years. Summary statistics, including the means, standard deviations, ranges, selected percentiles, measures of distribution, and coefficients of variation, are presented for the 56 hand dimensions. Also included are statistical variations by age, rank, and Corps within the sample, a complete correlation matrix, bivariate tables, and nomographs for various selected combinations of hand dimensions.

<sup>7</sup> Jones, C. E., J. L. Kobrick, and H. F. Gaydos. Anthropometric and Biomechanical Characteristics of the Hand. Technical Report EP-100, U.S. Army Quartermaster Research and Engineering Center, Natick, Massachusetts, September 1958. (AD 204 867)

<sup>8</sup> Vicinus, J. H. X-Ray Anthropometry of the Hand. Technical Report AMRL-TDR-62-111, Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio, September 1962. (AD 291 412)

<sup>9</sup> Garrett, J. W. Anthropometry of the Air Force Female Hand. Technical Report AMRL-TR-69-26, Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, March 1970. (AD 710 202)

In a second report by Garrett (1970),<sup>10</sup> descriptions of and data on 56 anthropometric dimensions of the hands of 148 male U.S. Air Force flight personnel are presented. Selected dimensional comparisons indicate that this sample is representative of the total group of USAF flight personnel. Summary statistics presented include the means, standard deviations, ranges, selected percentiles, and coefficients of variation. Also included are data on the age, rank, major Air Command, and commissioned status of the sample; a complete matrix of intercorrelations among the anthropometric dimensions; bivariate tables; multiple regression equations; and nomographs for selected combinations of dimensions. A tariff for the U.S. Air Force 12-size glove program, revised to reflect the latest anthropometric data, is presented in the appendix.

Recent studies of the anthropometry and selected biomechanical characteristics of hands are summarized in a journal article by Garrett (1971).<sup>11</sup> These include: (1) conventional anthropometry of male and female hands, (2) the anthropometry of the relaxed hand, (3) comparison of certain engineering, anthropometric and performance parameters between bare and pressure-gloved hands, and (4) the ability to retain grips on selected handles under high dynamic loads. The utility of these data for human factors engineering is discussed.

In addition to the technical reports on hands reviewed above, several general references also may be cited here.

Detailed comparisons of anthropometric data on the hands, based primarily upon the definitions of hand measurements, may be found in the encyclopedic two-volume Collation of Anthropometry by Garrett and Kennedy (1971).<sup>12</sup>

A significant and important source of anthropometric data is represented by the AMRL Data Bank, which is a comprehensive collection of body size information assembled and maintained by personnel of the Aerospace Medical Research Laboratory at Wright-Patterson Air Force Base, Ohio. This facility incorporates at a single center the raw data from most large-scale anthropometric surveys of U.S. military and civilian populations and also of many

<sup>10</sup> Garrett, J. W. Anthropometry of the Hands of Male Air Force Flight Personnel. Technical Report AMRL-TR-69-42, Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, March 1970. (AD 709 883)

<sup>11</sup> Garrett, J. W. The Adult Human Hand: Some Anthropometric and Biomechanical Considerations. *Human Factors*, Vol. 13, No. 2, 117-131, April 1971. (Also designated as Technical Report AMRL-TR-69-122; AD 724 061)

<sup>12</sup> Garrett, J. W., and K. W. Kennedy. A Collation of Anthropometry. Technical Report AMRL-TR-68-1 (2 volumes), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, March 1971. (AD 723 629 and AD 723 630)

foreign military populations. The material, which includes data on hand measurements, has been edited and standardized to make it reliable and readily available for recall and analysis as needed for specific research and applications. A number of associated computer programs have been devised to aid users of this resource in extracting and utilizing the data for particular tasks. The contents of the AMRL Data Bank have not been published as such. However, a technical report has been published by Churchill et al. (1977)<sup>13</sup> which describes in detail four of the U.S. Air Force anthropometric series included in the data bank. Also included in this report are descriptions of the tape formats, definitions of the measurement variables, and a printout of an editing program.

What is probably the single most useful publication of comparative anthropometric data is the Anthropometric Source Book, published in 1978 by the National Aeronautics and Space Administration.<sup>14</sup> The Source Book comprises three volumes. Volume I: Anthropometry for Designers, is a presentation in nine chapters of the fundamentals of anthropometry and anthropometric data, as well as applications in the design and sizing of clothing, equipment, and workspaces. Volume II: A Handbook of Anthropometric Data, contains summaries of anthropometric data from surveys of 61 military and civilian populations of both sexes from the United States, Europe, and Asia. Some 295 measured variables are defined and illustrated; these include measurements of the hands. For each variable there is a list of surveys in which it was measured and summary statistics and selected percentile values for each population cited. This volume is primarily a handbook of tabulated dimensional anthropometric data and is probably the most comprehensive source of summarized body size information currently in existence. Volume III: Annotated Bibliography of Anthropometry, lists 236 annotated references relating to the field of anthropometry and the applications of anthropometric data in both clothing and ergonomics. Taken together, the three volumes of the NASA Anthropometric Source Book, compiled and edited by Edmund Churchill, John T. McConville, and their associates of the Anthropology Research Project in Yellow Springs, Ohio, is a truly impressive publication, representing a valuable source of information on comparative anthropometric data.

Another recent and useful source of anthropometric data on the U.S. military population is the Department of Defense Military Handbook on the Anthropometry of U.S. Military Personnel (Metric).<sup>15</sup> In this official publication, statistical and selected percentile values are

<sup>13</sup>Churchill, E., P. Kikta, and T. Churchill. The AMRL Data Bank Library: Volumes I-V. Technical Report AMRL-TR-77-1, Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, October 1977. (AD A047 314)

<sup>14</sup>National Aeronautics and Space Administration (Edited by Staff of Anthropology Research Project, Webb Associates, Yellow Springs, Ohio). Anthropometric Source Book. NASA Reference Publication 1024 (3 volumes), National Aeronautics and Space Administration. Scientific and Technical Information Office, Washington, D.C., July 1978.

<sup>15</sup>Department of Defense. Military Handbook: Anthropometry of U.S. Military Personnel (Metric). DOD-HDBK-743 (Metric), U.S. Government Printing Office, Washington, D.C., 3 October 1980.

presented in centimeters for 192 body measurements, including hand measurements. The data have been compiled and collated from anthropometric surveys and studies on both men and women, carried out between 1946 and 1977 in the U.S. Army, Marine Corps, Navy, and Air Force.

### 3. COMPARATIVE ANTHROPOMETRIC DATA ON THE HAND

#### a. Sources of Anthropometric Data.

Comparative anthropometric data on the hand presented and discussed in this report have been drawn from 27 anthropometric surveys and studies carried out between 1942 and 1977. These comprise 19 series of men's hands and eight series of women's hands, representing measurements on over 78,000 individuals.

Six of the men's series are from the U.S. Army: U.S. Army men measured in 1946 and 1966; U.S. Army basic trainees measured in 1966 and 1977; and U.S. Army aviators measured in 1959 and 1970. U.S. Marine Corps men measured in 1966 are included, as well as U.S. Navy aviators measured in 1964 and U.S. Navy recruits measured in 1966. Seven series on men's hands are from the U.S. Air Force: U.S. Army Air Forces cadets and gunners measured in 1942; U.S. Air Force flying personnel measured in 1950 and 1967; U.S. Air Force basic trainees measured in 1952 and 1965; as well as a study of USAF men's hands measured in 1968. Three additional series on men's hands consist of Spanish-American War veterans measured in 1959, Veterans Administration veterans measured in 1970, and U.S. law enforcement officers measured in 1974.

Among the eight series on women's hands are: U.S. Army women measured in 1946 and 1977; Women's Army Service pilots (WASP) and U.S. Army Air Forces flying nurses measured in 1942; U.S. Air Force WAF trainees measured in 1952; U.S. Air Force women measured in 1968; and a study of USAF women's hands measured in 1968. In addition, a series of airline stewardess trainees, measured in 1971, has been included.

These sources of anthropometric data are summarized in Table 1. The number of individuals measured in each series and the mean age of the series also are indicated. References for these series in the form of published reports may be found in Section 12. REFERENCES. However, a technical report has not been published on U.S. Navy recruits (1966).

The available anthropometric data on hands thus include data on U.S. Army, U.S. Marine Corps, U.S. Navy, and U.S. Air Force personnel. Military ground troops are represented by U.S. Army and U.S. Marine Corps personnel, while military aviators consist of personnel of the Army, Navy and Air Force. Army and Air Force basic trainees, as well as Navy recruits, represent young men just beginning their military service. The data on women's hands are from the U.S. Army and U.S. Air Force.

In addition to representing all of the U.S. Armed Forces, the available anthropometric data on the hands also cover a time span of some 35 years, from the early surveys of 1942-1946 up to the later surveys of 1966-1977. It may be noted that the dimensions of the hand do not appear to have changed appreciably over a period of years among the military personnel cited here.

#### b. Anthropometric Measurements of the Hand.

Anthropometric data on the hand are presented for ten measurements: Hand Length, Palm Length, Thumb Crotch, Hand Breadth, Hand Breadth at Thumb, Hand Circumference,

Table 1. ANTHROPOMETRIC SERIES ON HANDS

No.	Men's Series	Number of individuals	Mean Age (years)	Reference number
1	US Army Men (1946)	24,487	24.3	47,61
2	US Army Men (1966)	6,682	22.2	61,62
3	US Army Basic Trainees (1966)	2,639	20.2	61,62
4	US Army Basic Trainees (1977)	287	19.7	43,61
5	US Army Aviators (1959)	500	30.2	58
6	US Army Aviators (1970)	1,482	26.2	7
7	US Marine Corps (1966)	2,008	20.9	63
8	US Navy Aviators (1964)	1,549	29.6	24
9	US Navy Recruits (1966)	4,095	19.9	none
10	USAAF Cadets (1942)	2,959	*	50
11	USAAF Gunners (1942)	583	*	50
12	USAF Flying Personnel (1950)	4,000	27.9	30
13	USAF Basic Trainees (1952)	3,328	18.9	12
14	USAF Basic Trainees (1965)	2,527	19.3	5
15	USAF Flying Personnel (1967)	2,420	30.0	27
16	USAF Men's Hands (1968)	148	31.5	20
17	Spanish-American War Veterans (1959)	130	81.6	11
18	Veterans Administration Veterans (1970)	2,109	42.9	10
19	Law Enforcement Officers (1974)	2,989	30.7	41

Women's Series

20	US Army Women (1946)	8,113	27.3	51,61
21	US Army Women (1977)	1,330	23.1	4,61
22	WASP Pilots (1942)	437	*	50
23	USAAF Flying Nurses (1942)	142	*	50
24	USAF WAF Basic Trainees (1952)	851	19.8	13
25	USAF Women (1968)	1,905	23.4	9
26	USAF Women's Hands (1968)	211	24.7	19
27	Airline Stewardess Trainees (1971)	423	22.1	53

\*Mean Age is not available.

**Hand Circumference at Thumb, Fist Circumference, Wrist Circumference, and Hand Thickness.** These ten hand measurements are illustrated in the Visual Index (page 22); definitions of the hand measurements may be found in the list of definitions (page 23).

Hand Length, from the wrist to the tip of the middle finger, represents the basic length of the hand. Palm length is essentially the length of the palm or the hand less the fingers. Thumb Crotch Length is a special measurement devised to fulfill a requirement for information on a critical seam in gloves. Hand Breadth is the basic width of the palm, while Hand Breadth at Thumb is the width of the hand including the base of the thumb. Hand Circumference is the girth of the palm, an important measurement which serves as the basis for glove sizing. Hand Circumference at Thumb is the girth of the hand including the base of the thumb. Fist Circumference is the girth of the clenched fist. Wrist Circumference is included with the hand measurements, since it is used as an indication of the sizing required for gauntlets or closures on handwear. Finally, Hand Thickness is the thickness of the hand at the knuckles, an important dimension involved in hand clearances.

In most surveys involving measurements of the hands, the right hand usually is measured. The right hand tends to be slightly larger in both length and breadth dimensions than the left.

#### 4. VISUAL INDEX OF HAND MEASUREMENTS

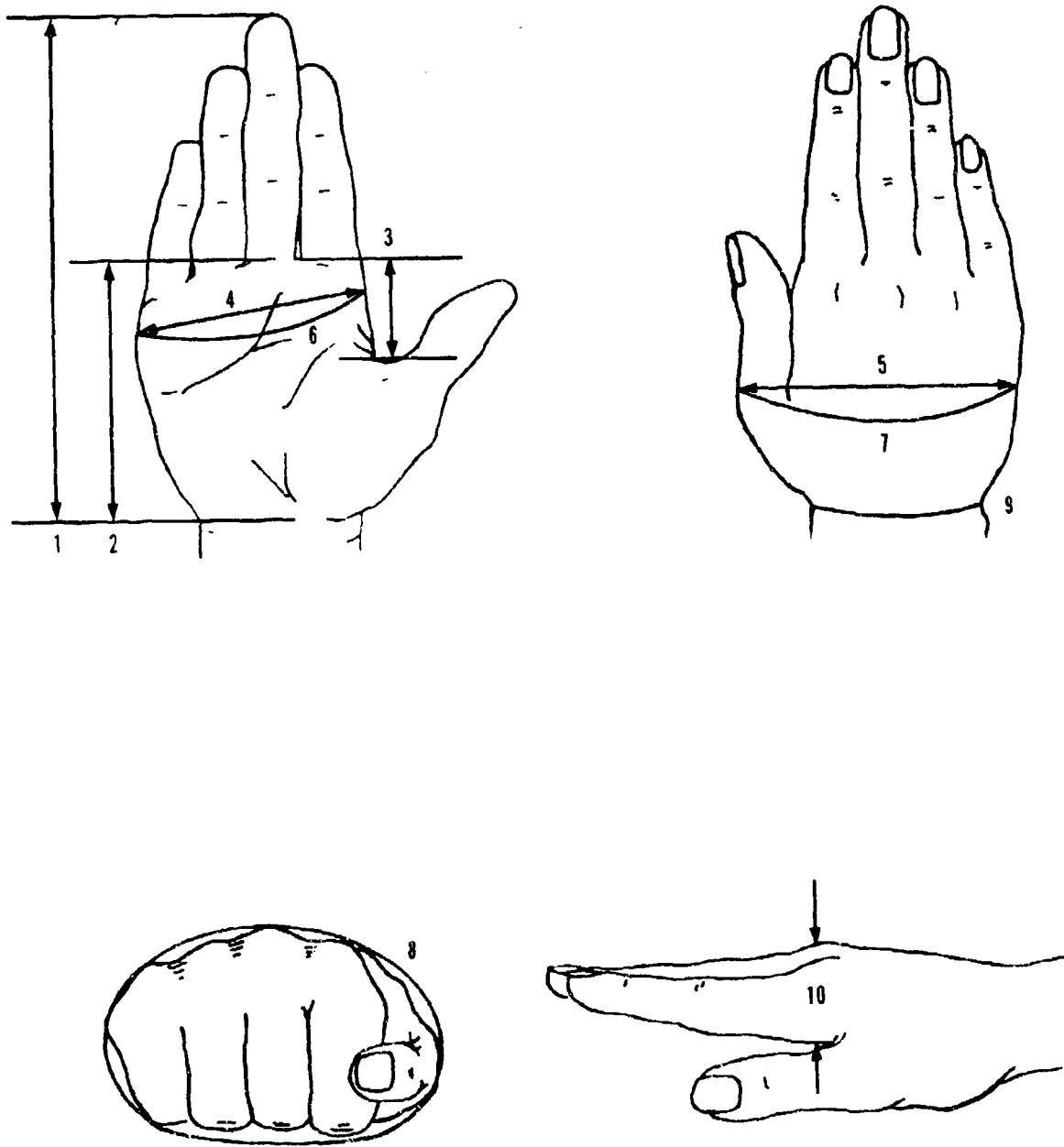


Figure 1. Hand Measurements

## 5. DEFINITIONS OF HAND MEASUREMENTS

- 1 **Hand Length** — the distance from the base of the hand at the wrist crease to the tip of the middle finger, measured along the long axis of the hand.
- 2 **Palm Length** — the distance from the base of the hand at the wrist crease to the furrow at the base of the middle finger.
- 3 **Thumb Crotch Length** — the distance from the skinfold at the base of the thumb to the notch between the first and second fingers, measured parallel to the long axis of the hand.
- 4 **Hand Breadth** — the breadth of the hand, measured across the ends of the metacarpal bones (metacarpal-phalangeal joints).
- 5 **Hand Breadth at Thumb** — the breadth of the hand, measured at the level of the first joint of the thumb (metacarpal-phalangeal joint).
- 6 **Hand Circumference** — the circumference of the hand, measured with the tape passing over the knuckles (metacarpal-phalangeal joints).
- 7 **Hand Circumference at Thumb** — the circumference of the hand, measured with the tape passing over the base of the thumb.
- 8 **Fist Circumference** — the circumference of the clenched fist (with the thumb lying across the end of the fist), measured with the tape passing over the knuckles and the thumb.
- 9 **Wrist Circumference** — the circumference of the wrist, measured at the level of the tip of the styloid process of the radius.
- 10 **Hand Thickness** — the thickness of the knuckle (metacarpal-first phalanx joint) of the middle finger.

## 6. STATISTICS

Comparative anthropometric data on the hand may be collated and analyzed in order to indicate ranges of variation in the sizes and dimensions of the hand. However, the reduction and processing of any anthropometric data, whether on the hands or on any other parts of the human body, involves the use of statistical procedures. Large amounts of data on large numbers of individuals are collected during anthropometric surveys of U.S. military personnel. Some statistics are necessary, therefore, in order to reduce these data into some logical and coherent form for presentation and application in design and sizing.

The statistical measures used in this report in the presentation of anthropometric data on the hands may be summarized as follows.

a. **The number of individuals.** The number of individuals measured in each of the series of military personnel is indicated in the tables by "N". The series included here usually represent from several hundred to several thousand individuals.

b. **The mean.** The mean as used here is the arithmetic mean for a hand dimension. This is the most widely used form of the "average" value.

c. **The standard deviation.** The standard deviation, indicated in the tables by "S.D.", is a statistical measure of variability. By definition, the standard deviation is the square root of the average of the squared deviations from the mean value. If most of the data tend to fall close to their mean value, the standard deviation will be small, while if many of the data are either much smaller or much larger than the mean, the standard deviation will be large. The mean of the hand dimension minus one standard deviation and plus one standard deviation usually will indicate a range for that dimension which will include about two-thirds of the data for that dimension. About 95 percent of the data will have values ranging from approximately two standard deviations below the mean to two standard deviations above it. Practically all of the data will fall within the range from three standard deviations below the mean to three standard deviations above the mean.

d. **The standard errors of the mean and standard deviation.** The standard error of the mean, shown as "SE(M)", and the standard error of the standard deviation, shown as "SE(SD)" in the tables, represent estimates of the magnitude of the sampling error. The standard error of the mean is computed by dividing the standard deviation by the square root of the sample size. The standard error of the standard deviation is obtained by dividing the standard deviation by the square root of twice the sample size. The standard errors for large samples of individuals will be small, while those for small samples will be relatively large.

e. **The coefficient of variation.** The coefficient of variation, indicated in the tables by "V(%)", is a restatement of the standard deviation in which the standard deviation is expressed as a percentage of the mean value. The coefficient of variation is a convenient measure for assessing the comparability of anthropometric data.

f. **The range.** The range in the tables of data is indicated by a minimum value (the smallest measurement), a maximum value (the largest measurement), and the total range, or the minimum value subtracted from the maximum value. The minimum and maximum values are the extreme values for that hand dimension, representing only two individuals — the smallest and the largest hand measurements.

g. **The stature ratio.** The stature ratio shown in the tables represents the hand dimension as related to stature. It is obtained by dividing the mean value for that dimension by the mean value of stature for that series. For example, a stature ratio of 0.110 for the hand length of U.S. Army Aviators (1970), as shown in Table 2a, indicates that mean hand length for this series is 11.0 percent of the mean stature for that series. Similarly, a stature ratio of 0.124 for the hand circumference of U.S. Army Men (1966), as shown in Table 7a, indicates that mean hand circumference for this series is 12.4 percent of the mean stature for that series. Stature ratios are more significant for larger measurements of the body; since the hand measurements are relatively small in terms of total stature, the stature ratios for hand measurements are rather low.

h. **Percentile values.** The selected percentile values shown in the tables of percentile values are the 1st, 2nd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, 98th, and 99th percentiles. The 50th percentile is equivalent to the median value, indicating that half of the data fall below and half of the data are above this value for a hand measurement. The range in the tables of percentile values is merely the 1st percentile value subtracted from the 99th percentile value, thus indicating the range or spread for 98 percent of the sample. The percentile values for a hand measurement represent a useful presentation of the range of variation for that dimension. The range indicated by the 25th to the 75th percentile values covers the middle 50 percent or half of the sample. The 5th percentile value for a hand measurement shows that five percent of the individuals in that sample are smaller than that value, while the 95th percentile value indicates that five percent are larger than that value for that hand measurement.

## 7. TABLES OF ANTHROPOMETRIC DATA

Available anthropometric data on the hand have been collated and are presented in tabular form in this section.

Virtually all anthropometric measurements are made in the metric system of millimeters and centimeters. In the first set of ten tables (Tables 2-11), the hand data are presented in metric values or centimeters. For the benefit of those who still may not be familiar with the metric system, the hand data are given in inches in the second set of ten tables (Tables 12-21).

The anthropometric data on hands are presented in a unique format in order to facilitate ready and convenient reference. The data for each hand measurement are given in tables on two facing pages. In Table "a" on the upper page are shown the various statistical values, such as means, standard deviations, and ranges, while selected percentile values are given in Table "b" on the lower or facing page. In this way, all of the available data for any hand dimension may be found on the two facing pages.

Anthropometric hand data for the men's series are given first, followed by the data for the women's series. In the statistical tables, the data are arranged in order of decreasing mean values, starting with the highest mean and progressing down to the lowest mean value. In the tables of percentile values, the data are arbitrarily arranged in decreasing order of the 50th percentile or median value, starting with the highest value and progressing down to the lowest value. It should be noted that the order or sequence of the series in the tables of percentile values is not necessarily the same as that in the tables of statistical values.

Not all of the hand measurements were taken in all of the anthropometric series cited here. Data for Hand Length and Hand Breadth are available for all of the series, while data for Hand Circumference and Wrist Circumference are available for most of the series. However, the rest of the hand measurements were taken in only a few of the anthropometric series.

Table 2a. STATISTICAL VALUES FOR HAND LENGTH

No.	Series	Values in Centimeters						Stature ratio		
		N	Mean	SE(M)	S.D.	SE(SD)	V(S)	Min.	Max.	Total
1	USAF Men's Hands (1968)	148	19.72	0.08	0.93	0.05	4.73	17.3	22.8	5.5
2	USAF Basic Trainees (1965)	2527	19.68	0.02	1.01	0.01	5.13	16.0	23.8	7.8
3	USAAF Cadets (1942)	2959	19.37	0.02	0.83	0.01	4.28	16.3	22.3	6.0
4	Law Enforcement Off. (1974)	2989	19.35	0.02	0.90	0.01	4.65	15.1	23.2	8.1
5	US Army Men (1946)	24,487	19.25	0.00	0.93	0.00	4.83	15.0	23.0	8.0
6	US Army Aviators (1970)	1482	19.20	0.02	0.87	0.02	4.55	16.3	22.3	6.0
7	USAF Gunners (1942)	583	19.18	0.04	0.89	0.03	4.64	16.0	22.0	5.0
8	USAF Basic Trainees (1952)	3328	19.16	0.02	0.96	0.01	5.01	16.3	22.2	5.9
9	US Navy Aviators (1964)	1549	19.12	0.02	0.86	0.02	4.50	16.4	22.8	6.4
10	USAF Flying Pers. (1967)	2420	19.11	0.02	0.82	0.01	4.29	16.7	22.2	5.5
11	USA Basic Trainees (1966)	2639	19.05	0.02	0.91	0.01	4.79	16.4	23.5	7.1
12	US Army Men (1966)	6682	19.03	0.01	0.96	0.01	5.06	15.5	23.5	8.0
13	USAF Flying Pers. (1950)	4000	19.02	0.01	0.85	0.01	4.47	14.9	22.2	7.3
14	VA Veterans (1970)	2109	19.02	0.02	0.85	0.01	4.47	16.0	21.8	5.8
15	USA Basic Trainees (1977)	287	19.00	0.05	0.99	0.04	5.19	15.9	21.7	5.8

Table 2b. PERCENTILE VALUES FOR HAND LENGTH

No.	Series	Percentiles in Centimeters								Range <u>1st-99th</u>	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>95th</u>		
1	USAF Basic Trainees (1965)	17.4	17.6	18.0	18.4	19.0	19.7	20.3	21.0	21.4	21.9
2	USAF Men's Hands (1968)	17.8	18.0	18.3	18.6	19.1	19.6	20.4	21.0	21.2	21.7
3	Law Enforcement Off. (1974)	17.2	17.5	17.9	18.2	18.7	19.3	19.9	20.5	20.9	22.0
4	USAAF Cadets (1942)	17.3	17.6	17.9	18.2	18.8	19.3	19.8	20.4	20.7	21.4
5	USAF Basic Trainees (1952)	17.0	17.2	17.6	18.0	18.5	19.2	19.8	20.4	20.8	21.3
6	US Army Men (1946)	17.1	17.4	17.8	18.1	18.6	19.2	19.8	20.4	20.8	21.0
7	US Army Aviators (1970)	17.2	17.4	17.8	18.1	18.6	19.2	19.8	20.3	20.7	21.0
8	USAAF Gunners (1942)	17.0	17.2	17.6	18.0	18.5	19.1	19.7	20.2	20.6	20.9
9	US Navy Aviators (1964)	17.3	17.4	17.7	18.0	18.5	19.1	19.7	20.2	20.6	20.9
10	USAF Flying Pers. (1967)	17.3	17.5	17.8	18.1	18.5	19.1	19.7	20.2	20.5	20.9
11	US Army Men (1966)	16.9	17.2	17.5	17.8	18.4	19.0	19.6	20.3	20.7	21.1
12	USA Basic Trainees (1966)	17.0	17.2	17.6	17.9	18.4	19.0	19.7	20.2	20.6	21.0
13	USA Basic Trainees (1977)	16.7	17.0	17.4	17.8	18.3	19.0	19.7	20.3	20.6	21.0
14	US Army Aviators (1959)	16.9	17.1	17.5	17.8	18.4	19.0	19.6	20.2	20.5	20.9
15	USAF Flying Pers. (1950)	17.1	17.3	17.6	17.9	18.4	19.0	19.6	20.1	20.5	20.8

Table 2a. STATISTICAL VALUES FOR HAND LENGTH (continued)

No.	Series	N	Values in Centimeters				Range	Max.	Total	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)				
16	US Army Aviators (1959)	500	18.97	0.04	0.86	0.03	4.53	16.3	21.7	5.4
17	US Marine Corps (1966)	2008	18.94	0.02	0.93	0.01	4.91	15.2	22.2	7.0
18	US Navy Recruits (1966)	4095	18.90	0.01	0.90	0.01	4.78	15.3	22.0	6.7
19	Spanish-American Vets. (1959)	130	18.82	0.07	0.79	0.05	4.20			•112
20	USAF Women (1968)	1905	18.38	0.02	0.96	0.02	5.22	15.3	22.0	6.7
21	USAF Women's Hands (1968)	211	17.93	0.06	0.86	0.04	4.79	15.7	20.5	•108
22	USAAF Nurses (1942)	142	17.60	0.06	0.70	0.04	3.98	14.9	19.6	4.7
23	WASP Pilots (1942)	437	17.60	0.04	0.80	0.03	4.55	14.5	20.8	6.3
24	US Army Women (1946)	8113	17.49	0.01	0.82	0.01	4.70	14.7	20.8	6.1
25	US Army Women (1977)	1331	17.44	0.02	0.90	0.02	5.17	14.9	20.4	5.5
26	Stewardess Trainees (1971)	423	17.33	0.04	0.79	0.03	4.58	15.2	19.5	4.3
27	USAF WAF Trainees (1952)	851	17.17	0.03	0.88	0.02	5.10	14.9	20.7	5.8

Table 2b. PERCENTILE VALUES FOR HAND LENGTH (continued)

No.	Series	Percentiles in Centimeters							Range <u>1st-99th</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>Median</u>	<u>75th</u>	<u>90th</u>				
16	VA Veterans (1970)	17.0	17.2	17.6	17.9	18.4	19.0	19.5	20.1	20.4	20.7	20.9	3.9
17	US Marine Corps (1966)	16.8	17.1	17.5	17.8	18.3	18.9	19.5	20.2	20.6	21.0	21.3	4.5
18	US Navy Recruits (1966)	16.8	17.1	17.4	17.8	18.3	18.9	19.5	20.1	20.4	20.9	21.2	4.4
19	Spanish-American Vets. (1959)	17.0	17.2	17.5	17.8	18.3	18.8	19.4	19.8	20.2	20.5	20.8	3.8
20	USAF Women (1968)	16.4	16.6	16.9	17.2	17.7	18.3	19.0	19.7	20.1	20.5	20.8	4.4
21	USAF Women's Hands (1968)	16.2	16.3	16.5	16.8	17.3	17.9	18.6	19.1	19.3	19.5	19.6	3.4
22	WASP Pilots (1942)	15.6	15.8	16.2	16.5	17.1	17.6	18.2	18.7	19.0	19.3	19.6	4.0
23	USAF Nurses (1942)	15.9	16.1	16.4	16.7	17.2	17.6	18.1	18.6	18.8	19.1	19.3	3.4
24	US Army Women (1946)	15.5	15.8	16.1	16.4	16.9	17.5	18.0	18.6	18.9	19.3	19.6	4.1
25	US Army Women (1977)	15.5	15.7	16.1	16.3	16.8	17.4	18.0	18.7	19.0	19.4	19.6	4.1
26	Stewardess Trainees (1971)	15.5	15.7	16.0	16.2	16.8	17.3	17.9	18.3	18.6	18.9	19.0	3.5
27	USAF WAF Trainees (1952)	15.3	15.5	15.8	16.0	16.5	17.2	17.8	18.3	18.6	19.0	19.4	4.1

Table 3a. STATISTICAL VALUES FOR FAIN LENGTH

No.	Series	N	Values in Centimeters					Range	Max.	Total	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)	V(%)				
1	USAF Basic Trainees (1965)	2527	11.54	0.01	0.69	0.01	5.98	8.8	13.8	5.0	.066
2	USAF Men's Hands (1968)	148	11.05	0.05	0.60	0.03	5.43	9.6	12.9	3.3	
3	US Army Aviators (1970)	1482	10.96	0.01	0.56	0.01	5.07	9.1	13.0	3.9	.063
4	USAF Basic Trainees (1952)	3321	10.91	0.01	0.63	0.01	5.74	8.2	13.4	5.2	.063
5	USAF Flying Pers. (1967)	2420	10.83	0.01	0.54	0.01	4.99	9.3	12.8	3.5	.061
6	USAF Flying Pers. (1950)	4000	10.77	0.01	0.54	0.01	5.01	8.6	12.6	4.0	.061
7	USA Basic Trainees (1977)	287	10.75	0.03	0.58	0.02	5.38	9.0	12.1	3.1	.062
8	USA Basic Trainees (1966)	2639	10.62	0.01	0.61	0.01	5.76	8.0	13.0	5.0	.061
9	US Army Men (1966)	6682	10.59	0.01	0.63	0.01	5.93	8.1	13.3	5.2	.061
10	US Marine Corps (1966)	2008	10.53	0.01	0.59	0.01	5.64	8.3	12.5	4.2	.060
11	US Navy Recruits (1966)	4095	10.35	0.01	0.58	0.01	5.64	7.3	12.6	5.3	.059
12	US Army Women (1977)	1331	9.88	0.01	0.52	0.01	5.29	8.2	11.6	3.4	.061
13	USAF Women's Hands (1968)	211	9.86	0.04	0.60	0.03	6.09	8.4	11.8	3.4	.061
14	Stewardess Trainees (1971)	423	9.68	0.03	0.54	0.02	5.56	8.2	11.1	2.9	.058
15	USAF WAF Trainees (1952)	850	9.50	0.02	0.64	0.02	6.72	7.4	11.4	4.0	.058

Table 3b. PERCENTILE VALUES FOR PALM LENGTH

No.	Series	Percentiles in Centimeters							Range <u>1st-99th</u>			
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>95th</u>	<u>98th</u>	<u>99th</u>
1	USAF Basic Trainees (1965)	10.0	10.2	10.4	10.7	11.1	11.5	12.0	12.4	12.7	13.0	13.3
2	USAF Men's Hands (1968)	9.9	10.0	10.2	10.3	10.6	11.0	11.4	11.9	12.1	12.5	12.8
3	USAF Basic Trainees (1952)	9.4	9.6	10.0	10.2	10.5	10.9	11.3	11.7	12.0	12.3	12.5
4	US Army Aviators (1970)	9.7	9.9	10.1	10.3	10.6	10.9	11.3	11.7	11.9	12.2	12.3
5	USAF Flying Pers. (1967)	9.6	9.3	10.0	10.2	10.5	10.8	11.2	11.6	11.8	12.0	12.1
6	USA Basic Trainees (1977)	9.4	9.6	9.8	10.0	10.4	10.8	11.2	11.5	11.7	12.0	12.1
7	USAF Flying Pers. (1950)	9.6	9.7	9.9	10.1	10.4	10.8	11.1	11.5	11.7	12.0	12.1
8	US Army Men (1966)	9.2	9.3	9.6	9.8	10.2	10.6	11.0	11.4	11.7	12.0	12.2
9	USA Basic Trainees (1966)	9.2	9.4	9.6	9.8	10.2	10.6	11.0	11.4	11.7	11.9	12.0
10	US Marine Corps (1966)	9.2	9.3	9.6	9.8	10.1	10.5	10.9	11.3	11.6	11.9	12.1
11	US Navy Recruits (1966)	9.0	9.2	9.4	9.6	10.0	10.4	10.7	11.1	11.3	11.6	11.8
12	USAF Women's Hands (1968)	8.6	8.7	8.9	9.1	9.4	9.9	10.2	10.6	10.8	11.2	11.5
13	US Army Women (1977)	8.8	8.9	9.0	9.2	9.5	9.9	10.2	10.6	10.8	11.0	11.2
14	Stewardess Trainees (1971)	8.4	8.5	8.8	9.0	9.4	9.7	10.1	10.4	10.6	10.8	11.0
15	USAF WAF Trainees (1952)	8.0	8.2	8.4	8.7	9.0	9.5	9.9	10.3	10.6	10.9	11.2

Table 4a. STATISTICAL VALUES FOR THUMB CROTCH LENGTH

No.	Series	N	Values in Centimeters				Range	Stature	ratio
			Mean	SE(M)	S.D.	SE(SD)			
1	US Marine Corps (1966)	2008	4.99	0.01	0.54	0.01	10.87	3.1	6.9
2	US Army Men (1966)	6682	4.97	0.01	0.52	0.00	10.45	3.3	7.5
3	US Navy Recruits (1966)	4095	4.95	0.01	0.49	0.01	9.95	2.5	6.7
4	USA Basic Trainees (1966)	2639	4.95	0.01	0.50	0.01	10.00	3.4	6.9

Table 4b. PERCENTILE VALUES FOR THUMB CROTCH LENGTH

No.	Series	Percentiles in Centimeters							Range <u>1st-29th</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u> Median	<u>75th</u>	<u>90th</u>	<u>95th</u>			
1	US Marine Corps (1966)	3.8	3.9	4.1	4.3	4.6	5.0	5.3	5.7	5.9	6.2	6.4	2.6
2	US Army Men (1966)	3.8	3.9	4.1	4.3	4.6	5.0	5.3	5.6	5.8	6.1	6.2	2.4
3	US Navy Recruits (1966)	3.8	4.0	4.2	4.3	4.6	5.0	5.3	5.6	5.8	6.0	6.2	2.4
4	USA Basic Trainees (1966)	3.8	3.9	4.2	4.3	4.6	5.0	5.3	5.6	5.8	6.0	6.1	2.3

Table 5a. STATISTICAL VALUES FOR HAND BREADTH

No.	Series	N	Values in Centimeters				Range	Stature	ratio
			Mean	SE(M)	S.D.	SE(SD)			
1	Law Enforcement Off. (1974)	2986	8.99	0.01	0.42	0.06	4.67	7.5	10.5
2	USAF Men's Hands (1968)	148	8.96	0.03	0.40	0.02	4.51	7.6	10.0
3	US Navy Aviators (1964)	1549	8.96	0.01	0.43	0.01	4.75	7.6	10.2
4	US Navy Recruits (1966)	4095	8.96	0.01	0.58	0.01	6.49	7.1	10.9
5	USA Basic Trainees (1977)	287	8.92	0.03	0.43	0.02	4.80	7.8	10.0
6	USAF Flying Pers. (1967)	2420	8.90	0.01	0.41	0.01	4.66	7.6	10.2
7	US Army Men (1966)	6681	8.90	0.01	0.49	0.00	5.52	7.1	10.7
8	USA Basic Trainees (1966)	2629	8.88	0.01	0.46	0.01	5.18	7.2	10.7
9	US Marine Corps (1966)	2008	8.86	0.01	0.44	0.01	4.98	7.7	10.9
10	USAF Basic Trainees (1965)	2527	8.86	0.01	0.48	0.01	5.42	7.4	10.5
11	US Army Aviators (1970)	1482	8.85	0.01	0.42	0.01	4.71	7.7	10.3
12	US Army Aviators (1957)	500	8.83	0.02	0.40	0.01	4.53	7.6	10.1
13	USAF Flying Pers. (1950)	4000	8.83	0.01	0.41	0.00	4.64	7.6	10.2
14	USAF Basic Trainees (1952)	3317	8.75	0.01	0.46	0.01	5.26	7.0	10.5
15	USAAF Cadets (1942)	2959	8.67	0.01	0.43	0.01	4.96	7.3	10.4

Table 5b. PERCENTILE VALUES FOR HAND BREATH

No.	Series	Percentiles in Centimeters							Range 29th- 11st-99th				
		1st	2nd	5th	10th	25th	50th	90th					
1	Law Enforcement Off. (1974)	8.0	8.1	8.3	8.5	8.7	9.0	9.3	9.5	9.7	9.9	10.0	2.0
2	US Navy Aviators (1964)	8.0	8.1	8.2	8.4	8.7	9.0	9.2	9.5	9.7	9.8	10.0	2.0
3	US Navy Recruits (1966)	7.7	7.9	8.1	8.2	8.5	8.9	9.4	9.7	10.0	10.2	10.3	2.6
4	USAF Men's Hands (1968)	8.1	8.2	8.3	8.5	8.7	8.9	9.2	9.5	9.7	10.0	10.2	2.1
5	USA Basic Trainees (1977)	8.0	8.1	8.3	8.4	8.6	8.9	9.2	9.5	9.7	10.0	10.2	2.2
6	US Army Men (1966)	7.8	7.9	8.1	8.3	8.5	8.9	9.2	9.5	9.7	10.0	10.1	2.3
7	USA Basic Trainees (1966)	7.9	8.0	8.2	8.3	8.6	8.9	9.2	9.5	9.7	9.9	10.0	2.1
8	USAF Basic Trainees (1965)	7.7	7.9	8.1	8.2	8.5	8.9	9.2	9.5	9.7	9.9	10.0	2.3
9	USAF Flying Pers. (1967)	8.0	8.1	8.2	8.4	8.6	8.9	9.2	9.4	9.6	9.8	9.9	1.9
10	US Army Aviators (1959)	8.0	8.1	8.2	8.3	8.5	8.9	9.1	9.4	9.5	9.7	9.8	1.8
11	US Marine Corps (1966)	7.9	8.0	8.2	8.3	8.6	8.8	9.2	9.4	9.6	9.8	9.9	2.0
12	US Army Aviators (1970)	8.0	8.0	8.2	8.3	8.6	8.8	9.1	9.4	9.5	9.7	9.9	1.9
13	USAF Flying Pers. (1950)	7.9	8.0	8.2	8.3	8.6	8.8	9.1	9.4	9.5	9.7	9.8	1.9
14	USAF Basic Trainees (1952)	7.7	7.8	8.0	8.2	8.4	8.8	9.0	9.3	9.5	9.7	9.8	2.1
15	US Army Men (1946)	7.5	7.6	7.8	8.0	8.3	8.7	9.0	9.3	9.5	9.7	9.7	2.4

Table 5a. STATISTICAL VALUES FOR HAND BREADTH (continued)

No.	Series	N	Mean	Values in Centimeters				Range	Max.	Total	Stature ratio
				SE(N)	S.D.	SE(SD)	V(%)				
16	US Army Men (1946)	24,488	8.67	0.00	0.48	0.00	5.54	6.0	11.0	5.0	.050
17	USAAF Gunners (1942)	583	8.59	0.02	0.41	0.01	4.77	7.2	9.8	2.6	.050
18	VA Veterans (1970)	2110	8.54	0.01	0.41	0.01	4.80	7.1	10.1	3.0	.049
19	Spanish-American Vets. (1959)	129	8.43	0.03	0.38	0.02	4.51				.050
20	US Army Women (1977)	1331	7.82	0.01	0.39	0.01	4.97	6.6	9.1	2.5	.048
21	WASP Pilots (1942)	140	7.80	0.01	0.30	0.01	3.85	6.5	8.8	2.3	.047
22	USAF Women's Hands (1968)	211	7.71	0.03	0.38	0.02	4.87	6.9	8.7	1.8	.047
23	USAAF Nurses (1942)	142	7.70	0.02	0.30	0.02	3.90	6.5	8.4	1.9	.048
24	US Army Women (1946)	8113	7.69	0.01	0.51	0.00	6.57	6.3	9.9	3.6	.047
25	USAF WAF Trainees (1952)	851	7.66	0.02	0.49	0.01	6.42	6.3	9.6	3.3	.047
26	USAF Women (1968)	1905	7.55	0.01	0.39	0.01	5.17	6.1	8.8	2.7	.047
27	Stewardess Trainees (1971)	423	7.37	0.02	0.32	0.01	4.34	6.5	8.4	1.9	.044

Table 5b. PERCENTILE VALUES FOR HAND BREADTH (continued)

No.	Series	Percentiles in Centimeters									Range <u>1st-99th</u>	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>95th</u>		
16	USAAF Cadets (1942)	7.8	7.9	8.0	8.1	8.4	8.6	8.9	9.2	9.4	9.7	9.9
17	USAAF Gunners (1942)	7.6	7.7	7.9	8.0	8.3	8.6	8.8	9.1	9.2	9.4	9.5
18	VA Veterans (1970)	7.5	7.6	7.8	8.0	8.2	8.5	8.8	9.0	9.2	9.3	9.4
19	Spaniard-American Vets. (1959)	7.6	7.7	7.9	8.0	8.2	8.4	8.7	8.9	9.1	9.3	9.4
20	US Army Women (1977)	7.0	7.0	7.2	7.3	7.6	7.8	8.1	8.3	8.5	8.6	8.7
21	WASP Pilots (1942)	6.9	7.0	7.2	7.3	7.5	7.8	8.0	8.2	8.4	8.6	8.7
22	USAF Women's Hands (1968)	6.8	6.9	7.1	7.2	7.4	7.7	8.0	8.2	8.3	8.5	8.6
23	USAAF Nurses (1942)	6.8	6.9	7.1	7.2	7.4	7.7	7.9	8.1	8.2	8.3	8.4
24	US Army Women (1946)	6.7	6.8	7.0	7.1	7.3	7.6	8.0	8.4	8.6	9.0	9.2
25	USAF WAF Trainees (1952)	6.6	6.7	6.9	7.0	7.3	7.6	8.0	8.3	8.5	8.8	9.0
26	USAF Women (1968)	6.7	6.8	6.9	7.1	7.3	7.6	7.8	8.1	8.2	8.4	8.5
27	Stewardess Trainees (1971)	6.6	6.7	6.8	7.0	7.1	7.3	7.6	7.8	8.0	8.1	8.2

Table 6a. STATISTICAL VALUES FOR HAND BREADTH AT THUMB

No., <u>Series</u>	N	Values in Centimeters				Range			Stature ratio
		<u>Mean</u>	<u>SE(M)</u>	<u>S.D.</u>	<u>SE(SD)</u>	<u>V(%)</u>	<u>Min.</u>	<u>Max.</u>	
1 US Navy Aviators (1964)	154.9	10.66	0.01	0.49	0.01	4.63	8.8	12.2	3.4
2 USAF Basic Trainees (1952)	3316	10.47	0.01	0.64	0.01	6.07	8.1	12.8	4.7
3 USAF Flying Pers. (1950)	4000	10.35	0.01	0.53	0.01	5.12	8.5	12.1	3.6
4 USAF Flying Pers. (1967)	2420	10.19	0.01	0.50	0.01	4.86	8.6	12.3	3.7
5 USAF WAF Trainees (1952)	844	9.18	0.02	0.59	0.01	6.39	7.5	10.7	3.2

Table 6b. PERCENTILE VALUES FOR HAND BREADTH AT THUMB

Table 7a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE

No.	Series	N	Values in Centimeters						Range Min.	Range Max.	Total	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)	V(%)					
1	US Marine Corps (1966)	2008	21.68	0.02	1.11	0.02	5.10	18.1	25.6	7.5	.124	
2	US Army Men (1966)	6682	21.61	0.01	1.14	0.01	5.26	17.8	26.3	8.5	.124	
3	USA Basic Trainees (1966)	2639	21.60	0.02	1.12	0.02	5.19	18.2	26.1	7.9	.124	
4	USAF Men's Hands (1968)	148	21.59	0.07	0.90	0.05	4.17	19.7	24.4	4.7		
5	USAF Flying Pers. (1967)	2120	21.55	0.02	0.94	0.01	4.34	18.4	24.7	6.3	.122	
6	USAF Basic Trainees (1952)	3311	21.49	0.03	1.48	0.02	6.89	12.0	32.0	20.0	.123	
7	US Army Aviators (1959)	500	21.46	0.04	0.97	0.03	4.52	18.8	24.7	5.9	.122	
8	USAF Basic Trainees (1965)	2527	21.45	0.02	1.03	0.01	4.80	17.2	25.5	8.3	.123	
9	Law Enforcement Off. (1974)	2985	21.43	0.02	1.02	0.01	4.76	18.0	27.8	9.8	.120	
10	US Navy Recruits (1966)	4095	21.42	0.02	1.08	0.01	5.04	18.0	25.5	7.5	.122	
11	US Navy Aviators (1964)	1549	21.38	0.03	1.00	0.02	4.69	17.2	25.0	7.8	.120	
12	US Army Aviators (1970)	1482	21.18	0.03	1.00	0.02	4.70	18.3	24.1	5.8	.121	
13	USA Basic Trainees (1977)	287	21.11	0.06	1.00	0.04	4.73	18.1	24.0	5.9	.121	

Table 7b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE

No.	Series	Percentiles in Centimeters								Range (1st-99th)
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	
1	US Marine Corps (1966)	19.3	19.5	19.9	20.3	20.9	21.7	22.4	23.1	23.5
2	US Army Men (1966)	19.1	19.4	19.8	20.2	20.8	21.6	22.3	23.1	23.6
3	USA Basic Trainees (1966)	19.2	19.5	19.9	20.2	20.8	21.5	22.3	23.1	23.6
4	USAF Basic Trainees (1965)	19.2	19.4	19.8	20.1	20.8	21.5	22.1	22.8	23.2
5	USAF Men's Hands (1968)	19.4	19.6	20.0	20.5	21.0	21.5	22.2	22.8	23.1
6	USAF Flying Pers. (1967)	19.4	19.7	20.0	20.4	20.9	21.5	22.2	22.8	23.2
7	USAF Basic Trainees (1952)	18.5	18.9	19.5	19.9	20.6	21.4	22.2	22.9	23.5
8	US Navy Recruits (1966)	19.1	19.3	19.7	20.0	20.7	21.4	22.1	22.8	23.1
9	Law Enforcement Off. (1974)	19.0	19.3	19.7	20.1	20.7	21.4	22.1	22.8	23.5
10	US Army Aviators (1959)	19.2	19.4	19.9	20.2	20.8	21.4	22.1	22.7	23.1
11	US Navy Aviators (1964)	19.0	19.3	19.7	20.1	20.7	21.4	22.0	22.6	23.0
12	US Army Aviators (1970)	18.9	19.2	19.6	19.9	20.5	21.2	21.8	22.5	22.9
13	USA Basic Trainees (1977)	18.9	19.1	19.5	19.9	20.5	21.1	21.8	22.4	22.8

Table 7a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE (continued)

No.	Series	Values in Centimeters						Range	Stature ratio
		N	Mean	SE(M)	S.D.	SE(SD)	V(%)		
14	USAF WAF Trainees (1952)	851	18.99	0.04	1.17	0.03	6.14	14.0 - 27.0	13.0 •117
15	USAF Women's Hands (1968)	211	18.71	0.06	0.83	0.04	4.43	16.7 - 21.1	4.4 •115
16	US Army Women (1977)	1331	18.45	0.02	0.86	0.02	4.64	15.8 - 21.2	5.4 •113
17	USAF Women (1968)	1905	18.32	0.02	0.91	0.01	4.97	15.0 - 21.5	6.5 •113

Table 7b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE (continued)

No.	Series	Percentiles in Centimeters							Range <u>1st-99th</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>					
14	USAF AF Trainees (1952)	16.7	17.0	17.4	17.7	18.4	19.0	19.6	20.3	20.7	21.3	21.8	5.1
15	USAF Women's Hands (1968)	16.9	17.1	17.4	17.7	18.1	18.6	19.2	19.8	20.1	20.5	20.8	3.9
16	US Army Women (1977)	16.5	16.7	17.0	17.3	17.8	18.4	19.0	19.6	19.9	20.2	20.4	3.9
17	USAF Women (1968)	16.3	16.5	16.8	17.1	17.7	18.3	18.9	19.5	19.8	20.3	20.6	4.3

Table 8a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE AT THUMB

No.	Series	N	Mean	Values in Centimeters				Range	Max.	Total	Statute ratio
				SE(M)	S.D.	SE(SD)	V(%)				
1	USAF Flying Pers. (1967)	2420	25.75	0.02	1.08	0.02	4.19	21.9	29.9	80.0	.145
2	US Navy Aviators (1964)	1549	25.46	0.03	1.12	0.02	4.41	22.0	29.2	70.2	.143
3	USAF Basic Trainees (1965)	2527	25.12	0.02	1.24	0.02	4.94	21.4	29.3	70.9	.143

Table 8b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE AT THUMB

No.	Series	Percentiles in Centimeters							Range <u>1st-99th</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>					
1	USAF Flying Pers. (1967)	23.4	23.7	24.0	24.4	25.0	25.7	26.5	27.2	27.6	28.1	28.3	4.9
2	US Navy Aviators (1964)	22.9	23.2	23.6	24.0	24.7	25.4	26.2	26.9	27.4	27.8	28.1	5.2
3	USAF Basic Trainees (1965)	22.3	22.6	23.1	23.6	24.3	25.1	26.0	26.7	27.2	27.7	28.1	5.8

Table 9a. STATISTICAL VALUES FOR FIRST CIRCUMFERENCE

No.	Series	N	Values in Centimeters					Range Max.	Range Min.	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)	V(%)			
1	USAF Men's Hands (1968)	148	29.61	0.11	1.35	0.08	4.54	26.3	33.0	6.7
2	USAF Flying Pers. (1950)	4000	29.32	0.02	1.36	0.02	4.64	25.0	34.1	.167
3	USAF Basic Trainees (1952)	3300	28.74	0.03	1.61	0.02	5.60	19.0	39.0	.165
4	USAF WAF Trainees (1952)	851	25.08	0.05	1.32	0.02	5.27	21.0	29.0	8.0
5	USAF Women's Hands (1968)	211	24.83	0.09	1.31	0.06	5.27	21.8	29.1	7.3

Table 9b. PERCENTILE VALUES FOR FIST CIRCUMFERENCE

No.	Series	Percentiles in Centimeters								Range <u>1st-99th</u>	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>		
1	USAF Men's Hands (1968)	26.3	26.7	27.3	27.8	28.7	29.6	30.5	31.4	31.9	32.5
2	USAF Flying Pers. (1950)	26.2	26.6	27.1	27.6	28.4	29.3	30.2	31.1	31.6	32.8
3	USAF Basic Trainees (1952)	25.0	25.7	26.4	26.9	27.8	28.7	29.7	30.7	31.2	32.5
4	USAF WAF Trainees (1952)	22.1	22.4	23.0	23.4	24.2	25.1	26.0	26.7	27.2	27.7
5	USAF Women's Hands (1968)	22.1	22.4	22.9	23.2	23.9	24.7	25.7	26.6	27.2	27.8
										6.5	
										6.3	
										6.0	

Table 10a. STATISTICAL VALUES FOR MAST CIRCUMFERENCE

No.	Series	N	Values in Centimeters						Range Max.	Range Total	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)	V(%)	Min.			
1	Air Control Trainees (1961)	680	17.60	0.04	1.14	0.03	6.47	14.6	22.2	7.6	.100
2	USAF Flying Pers. (1967)	2420	17.59	0.02	0.92	0.01	5.23	15.1	20.8	5.7	.099
3	USAF Men's Hands (1968)	148	17.50	0.08	0.94	0.05	5.39	15.1	20.0	4.9	
4	USAF Basic Trainees (1952)	3326	17.46	0.02	1.02	0.01	5.84	14.0	23.0	9.0	.100
5	USAF Flying Pers. (1950)	4000	17.37	0.01	0.91	0.01	5.24	14.4	21.6	7.2	.099
6	VA Veterans (1970)	2099	17.34	0.02	1.02	0.02	5.88	14.0	21.8	7.8	.099
7	JSAR Basic Trainees (1965)	2527	17.14	0.02	0.85	0.01	4.96	14.0	20.4	6.4	.098
8	USA Basic Trainees (1966)	2639	17.08	0.02	0.85	0.01	4.99	14.6	20.6	6.0	.098
9	US Army Men (1966)	6682	17.06	0.01	0.88	0.01	5.13	13.7	21.6	7.9	.098
10	US Navy Aviators (1964)	1549	17.04	0.02	0.80	0.01	4.72	14.2	19.4	5.2	.096
11	US Army Men (1946)	24,391	17.02	0.00	1.03	0.00	6.05	13.5	21.0	6.5	.098
12	US Marine Corps (1966)	2008	17.01	0.02	0.81	0.01	4.74	14.7	19.6	4.9	.097
13	US Navy Recruits (1966)	4095	16.96	0.01	0.87	0.01	5.12	13.9	20.0	6.1	.097
14	US Army Aviators (1970)	1482	16.86	0.03	1.03	0.02	6.13	13.7	20.3	6.6	.097

Table 10b. PERCENTILE VALUES FOR WRIST CIRCUMFERENCE

No.	Series	Percentiles in Centimeters								Range (1st-99th)	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>		
1	USAF Basic Trainees (1952)	15.4	15.6	16.0	16.3	16.8	17.5	18.2	18.9	19.7	20.0
2	USAF Flying Pers. (1967)	15.7	15.9	16.2	16.5	16.9	17.5	18.2	18.8	19.7	20.0
3	USAF Men's Hands (1968)	15.5	15.7	16.0	16.3	16.9	17.5	18.0	18.7	19.1	19.8
4	USAF Flying Pers. (1950)	15.4	15.6	16.0	16.2	16.8	17.4	18.0	18.6	18.9	19.4
5	VA Veterans (1970)	15.5	15.7	16.0	16.3	16.8	17.3	17.8	18.5	19.0	19.6
6	Air Control Trainees (1961)	14.7	15.0	15.5	16.0	16.5	17.2	18.0	18.8	19.2	19.8
7	USAF Basic Trainees (1965)	15.2	15.5	15.8	16.1	16.6	17.1	17.7	18.2	18.6	19.0
8	US Army Men (1946)	14.7	15.0	15.2	15.7	16.3	17.0	17.8	18.5	18.8	19.3
9	USA Basic Trainees (1966)	15.2	15.4	15.8	16.0	16.5	17.0	17.6	18.2	18.6	19.0
10	US Army Men (1966)	15.1	15.3	15.7	16.0	16.5	17.0	17.6	18.2	18.6	19.0
11	US Navy Aviators (1964)	15.2	15.4	15.8	16.0	16.5	17.0	17.6	18.1	18.4	18.8
12	US Marine Corps (1966)	15.2	15.4	15.7	16.0	16.4	17.0	17.5	18.1	18.4	18.8
13	US Navy Recruits (1966)	15.1	15.2	15.6	15.9	16.4	16.9	17.5	18.1	18.4	18.9
14	US Army Aviators (1970)	14.6	14.9	15.3	15.6	16.2	16.8	17.5	18.2	18.7	19.3

Table 10a. STATISTICAL VALUES FOR WRIST CIRCUMFERENCE (continued)

No.	Series	N	Values in Centimeters				Range	Statute ratio			
			Mean	SE(M)	S.D.	V(SD)					
15	USAF WAF Trainees (1952)	848	15.44	0.04	1.03	0.03	6.70	13.0	20.0	7.0	.095
16	USAF Women's Hands (1968)	211	14.98	0.05	0.71	0.03	4.75	13.3	17.1	3.8	.092
17	USAF Women (1968)	1905	14.96	0.02	0.71	0.01	4.75	12.5	17.6	5.1	.092
18	US Army Women (1946)	8112	14.72	0.01	0.81	0.01	5.53	11.4	18.4	7.0	.091
19	US Army Women (1977)	1331	14.71	0.02	0.69	0.01	4.66	12.9	17.5	4.6	.090
20	Stewardess Trainees (1971)	422	13.68	0.03	0.69	0.02	5.06	11.8	16.0	4.2	.082

Table 10b. PERCENTILE VALUES FOR WRIST CIRCUMFERENCE (continued)

No.	Series	Percentiles in Centimeters								Range <u>95<sub>uu</sub></u> (1st-99 <sub>th</sub> )			
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>Median</u>	<u>20th</u>	<u>75th</u>				
15	USAF WAF Trainees (1952)	13.6	13.7	14.0	14.2	14.7	15.3	16.0	16.8	17.4	18.1	18.6	5.0
16	USAF Women's Hands (1968)	13.4	13.6	13.8	14.1	14.5	15.0	15.5	16.0	16.2	16.5	16.7	3.3
17	USAF Women (1968)	13.4	13.5	13.8	14.0	14.4	14.9	15.4	15.9	16.2	16.6	16.8	3.4
18	US Army Women (1946)	13.0	13.2	13.5	13.7	14.2	14.7	15.2	15.8	16.1	16.6	17.0	4.0
19	US Army Women (1977)	13.2	13.4	13.6	13.8	14.2	14.7	15.2	15.6	15.8	16.1	16.2	3.0
20	Stewardess Trainees (1971)	12.2	12.4	12.6	12.9	13.2	13.7	14.2	14.7	14.9	15.2	15.4	3.2

Table 11a. STATISTICAL VALUES FOR HAND THICKNESS<sup>a</sup>

No.	Series	Values in Centimeters						Range	Statute ratio
		N	Mean	SE(M)	S.D.	SE(SD)	V(%)		
1	USAF Men's Hands (1968)	148	3.29	0.02	0.20	0.01	5.99	2.8	3.7
2	US Navy Aviators (1964)	1549	3.11	0.01	0.21	0.00	6.69	2.2	4.0
3	USAF Basic Trainees (1952)	2019	3.03	0.00	0.23	0.00	7.65	2.0	4.0
4	USAF Flying Pers. (1950)	4000	2.97	0.00	0.17	0.00	5.72	2.4	3.6
5	USAF Basic Trainees (1965)	2521	2.96	0.00	0.21	0.00	7.09	2.2	3.8
6	USAF Flying Pers. (1967)	2420	2.77	0.00	0.21	0.00	7.56	2.0	3.6
7	USAF Women's Hands (1968)	211	2.76	0.01	0.18	0.01	6.41	2.4	3.3
8	USAF WAF Trainees (1952)	350	2.48	0.01	0.24	0.01	9.60	1.9	3.6

<sup>a</sup>Thickness of knuckle (metacarpal-first phalanx joint) of middle finger.

Table 11b. PERCENTILE VALUES FOR HAND THICKNESS<sup>a</sup>

No.	Series	Percentiles in Centimeters						Range <u>99th (1st-99th)</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>Median</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>98th</u>	
1	USAF Men's Hands (1968)	2.9	2.9	3.0	3.0	3.1	3.3	3.4	3.5	3.6	3.6	3.7
2	US Navy Aviators (1964)	2.7	2.7	2.8	2.9	3.0	3.1	3.2	3.4	3.5	3.6	3.7
3	USAF Basic Trainees (1952)	2.5	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.6
4	USAF Basic Trainees (1965)	2.5	2.5	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.5
5	USAF Flying Pers. (1950)	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.4
6	USAF Flying Pers. (1967)	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0	3.1	3.2	3.3
7	USAF Women's Hands (1968)	2.4	2.4	2.5	2.5	2.6	2.8	2.9	3.0	3.0	3.1	3.2
8	USAF WAF Trainees (1952)	2.0	2.1	2.1	2.2	2.3	2.4	2.6	2.8	2.9	3.0	3.1

<sup>a</sup>Thickness of knuckle (metacarpal-first phalanx joint) of middle finger.

Table 12a. STATISTICAL VALUES FOR HAND LENGTH

No.	Series	N	Values in Inches						Range Min.	Range Max.	Range Total	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)	V(S)					
1	USAF Men's Hands (1968)	243	7.76	0.03	0.37	0.02	4.73	6.81	8.98	2.17		
2	USAF Basic Trainees (1965)	2527	7.75	0.01	0.40	0.01	5.16	6.32	9.38	3.06	•112	
3	Law Enforcement Off. (1974)	2989	7.62	0.01	0.36	0.00	4.72	5.94	9.13	3.19	•109	
4	USAAF Cadets (1942)	2952	7.59	0.01	0.33	0.00	4.35	6.42	8.78	2.36	•110	
5	US Army Men (1946)	24,487	7.58	0.00	0.36	0.00	4.75	5.91	9.06	3.15	•111	
56	US Army Aviators (1970)	1482	7.56	0.01	0.34	0.01	4.55	6.42	8.78	2.36	•110	
7	USAF Basic Trainees (1952)	3328	7.54	0.01	0.38	0.01	5.03	6.42	8.74	2.32	•110	
8	US Navy Aviators (1964)	1549	7.53	0.01	0.34	0.01	4.50	6.48	8.99	2.51	•108	
9	USAAF Gunners (1942)	582	7.53	0.01	0.34	0.01	4.52	6.30	8.66	2.36	•111	
10	USAF Flying Pers. (1967)	2420	7.52	0.01	0.32	0.00	4.29	6.57	8.74	2.17	•108	
11	USA Basic Trainees (1966)	2639	7.50	0.01	0.36	0.00	4.79	6.44	9.26	2.82	•109	
12	USAF Flying Pers. (1950)	4000	7.49	0.01	0.33	0.00	4.47	5.87	8.74	2.87	•108	
13	VA Veterans (1970)	2109	7.49	0.01	0.33	0.00	4.41	6.30	8.58	2.28	•109	
14	US Army Men (1966)	6682	7.49	0.00	0.38	0.00	5.06	6.10	9.25	3.15	•109	
15	USA Basic Trainees (1977)	287	7.48	0.02	0.39	0.02	5.21	6.26	8.54	2.28	•109	

Table 12b. PERCENTILE VALUES FOR HAND LENGTH

No.	Series	Percentiles in Inches							Range (1st-99th)				
		1st	2nd	5th	10th	25th	50th	75th					
1	USAF Basic Trainees (1965)	6.84	6.94	7.09	7.24	7.48	7.74	8.00	8.25	8.41	8.62	8.79	1.94
2	USAF Men's Hands (1968)	7.02	7.10	7.21	7.34	7.50	7.73	8.01	8.35	8.33	8.55	8.67	1.65
3	Law Enforcement Off. (1974)	6.77	6.89	7.04	7.18	7.38	7.61	7.84	8.08	8.21	8.42	8.54	1.77
4	USAAF Cadets (1942)	6.85	6.93	7.06	7.18	7.38	7.59	7.81	8.03	8.16	8.30	8.40	1.55
5	US Army Men (1946)	6.74	6.84	7.00	7.12	7.33	7.57	7.81	8.04	8.18	8.35	8.47	1.73
57	US Army Aviators (1970)	6.76	6.85	7.00	7.12	7.33	7.56	7.78	8.00	8.14	8.32	8.45	1.69
7	USAF Basic Trainees (1952)	6.67	6.76	6.94	7.08	7.25	7.54	7.78	8.02	8.18	8.33	8.52	1.84
8	USAAF Gunners (1942)	6.80	6.87	6.93	7.10	7.29	7.53	7.77	7.96	8.10	8.25	8.35	1.55
9	US Navy Aviators (1964)	6.81	6.87	6.98	7.09	7.29	7.52	7.76	7.97	8.09	8.23	8.32	1.51
10	USAF Flying Pers. (1967)	6.79	6.88	7.00	7.11	7.30	7.51	7.74	7.94	8.07	8.21	8.30	1.51
11	USA Basic Trainees (1966)	6.71	6.79	6.92	7.04	7.25	7.49	7.74	7.97	8.11	8.27	8.38	1.67
12	US Army Men (1966)	6.66	6.75	6.90	7.02	7.23	7.48	7.74	7.98	8.13	8.31	8.44	1.78
13	USA Basic Trainees (1977)	6.57	6.69	6.85	7.01	7.20	7.48	7.76	7.99	8.11	8.27	8.39	1.82
14	USAF Flying Pers. (1950)	6.73	6.81	6.93	7.05	7.24	7.48	7.72	7.91	8.07	8.19	8.27	1.54
15	US Army Aviators (1959)	6.66	6.75	6.88	7.01	7.23	7.46	7.70	7.94	8.07	8.23	8.33	1.67

Table 12a. STATISTICAL VALUES FOR HAND LENGTH (continued)

No.	Series	N	Mean	Values in Inches				Range	Max.	Total	Stature ratio
				SE(M)	S.D.	SE(SD)	V(%)				
16	US Army Aviators (1959)	500	7.47	0.02	0.34	0.01	4.55	6.42	8.54	2.12	.107
17	US Marine Corps (1966)	2008	7.46	0.01	0.37	0.01	4.91	5.98	8.74	2.76	.109
18	US Navy Recruits (1966)	4095	7.44	0.01	0.36	0.00	4.78	6.02	8.66	2.64	.108
19	Spanish-American Vets. (1959)	130	7.41	0.03	0.31	0.02	4.18				.112
20	USAF Women (1968)	1905	7.24	0.01	0.38	0.01	5.25	6.02	8.66	2.64	.113
21	USAF Women's Hands (1968)	211	7.06	0.02	0.34	0.02	4.79	6.18	8.07	1.89	.110
22	WASP Pilots (1942)	437	6.90	0.01	0.30	0.01	4.35	5.71	8.19	2.48	.106
23	USAAF Nurses (1942)	142	6.90	0.03	0.30	0.02	4.35	5.87	7.72	1.85	.109
24	US Army Women (1946)	8113	6.88	0.00	0.32	0.00	4.70	5.79	8.19	2.40	.108
25	US Army Women (1977)	1331	6.87	0.01	0.35	0.01	5.09	5.87	8.03	2.16	.107
26	Stewardess Trainees (1971)	423	6.82	0.02	0.31	0.01	4.58	5.98	7.68	1.70	.104
27	USAF WAF Trainees (1952)	851	6.76	0.01	0.34	0.01	5.10	5.87	8.15	2.28	.106

Table 12b. PERCENTILE VALUES FOR HAND LENGTH (continued)

No.	Series	Percentiles in Inches									Range <u>1st-99th</u>		
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>Median</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>			
16	V.A. Veterans (1970)	6.69	6.77	6.93	7.05	7.24	7.48	7.68	7.91	8.03	8.15	8.23	1.54
17	US Marine Corps (1966)	6.62	6.73	6.88	7.01	7.21	7.44	7.69	7.93	8.04	8.28	8.40	1.78
18	US Navy Recruits (1966)	6.63	6.72	6.87	6.99	7.20	7.43	7.67	7.90	8.04	8.22	8.35	1.72
19	Spanish-American Vets. (1959)	6.70	6.75	6.90	7.00	7.20	7.40	7.60	7.80	7.90	8.05	8.15	1.45
20	USAF Women (1968)	6.44	6.53	6.65	6.77	6.97	7.22	7.48	7.74	7.87	8.06	8.17	1.73
21	USAF Women's Ranks (1968)	6.37	6.41	6.51	6.61	6.82	7.06	7.31	7.50	7.60	7.69	7.73	1.36
22	WASP Pilots (1942)	6.20	6.30	6.40	6.50	6.70	6.90	7.20	7.40	7.50	7.70	7.80	1.60
23	USAAF Nurses (1942)	6.40	6.45	6.50	6.60	6.75	6.90	7.10	7.30	7.40	7.55	7.70	1.30
24	US Army Women (1946)	6.11	6.21	6.35	6.47	6.66	6.87	7.10	7.31	7.45	7.61	7.72	1.61
25	US Army Women (1977)	6.10	6.19	6.32	6.43	6.62	6.84	7.10	7.35	7.50	7.65	7.74	1.64
26	Stewardess Trainees (1971)	6.09	6.16	6.28	6.40	6.60	6.82	7.03	7.22	7.32	7.43	7.50	1.41
27	USAF WAF Trainees (1952)	6.03	6.11	6.23	6.32	6.50	6.77	7.00	7.21	7.33	7.48	7.64	1.61

Table 13a. STATISTICAL VALUES FOR PAM LENGTH

No.	Series	N	Mean	Values in Inches				Range Max.	Total	Stature ratio
				SE(M)	S.D.	SE(SD)	V(%)			
1	USAF Basic Trainees (1965)	2527	4.54	0.01	0.27	0.00	5.95	3.48	5.44	1.96
2	USAF Men's Hands (1968)	148	4.35	0.02	0.24	0.01	5.43	3.78	5.08	1.30
3	US Army Aviators (1970)	1482	4.31	0.01	0.22	0.00	5.07	3.58	5.12	1.54
4	USAF Basic Trainees (1952)	3321	4.29	0.01	0.25	0.01	5.74	3.23	5.28	2.05
5	USAF Flying Pers. (1967)	2420	4.26	0.00	0.21	0.00	4.99	3.66	5.04	1.38
6	USAF Flying Pers. (1950)	4000	4.24	0.00	0.21	0.00	5.01	3.39	4.96	1.57
7	USA Basic Trainees (1977)	287	4.23	0.01	0.23	0.01	5.44	3.54	4.76	1.22
8	USA Basic Trainees (1966)	2639	4.18	0.00	0.24	0.00	5.76	3.17	5.13	1.96
9	US Army Men (1965)	6682	4.17	0.00	0.25	0.00	5.93	3.19	5.24	2.05
10	US Marine Corps (1966)	2008	4.15	0.01	0.23	0.00	5.64	3.27	4.92	1.65
11	US Navy Recruits (1966)	4095	4.08	0.00	0.23	0.00	5.64	2.87	4.96	2.09
12	US Army Women (1977)	1331	3.89	0.01	0.21	0.00	5.40	3.23	4.57	1.34
13	USAF Women's Hands (1968)	211	3.88	0.02	0.24	0.01	6.09	3.31	4.65	1.34
14	Stewardess Trainees (1971)	423	3.81	0.01	0.21	0.01	5.56	3.23	4.37	1.24
15	USAF WAF Trainees (1952)	850	3.74	0.01	0.25	0.01	6.72	2.91	4.49	1.58

Table 13b. PERCENTILE VALUES FOR PAIN LENGTH

No.	Series	Percentiles in Inches							Range <u>99th (1st-99th)</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>90th</u>					
1	USAF Basic Trainees (1965)	3.95	4.00	4.10	4.19	4.36	4.54	4.72	4.89	5.00	5.13	5.23	1.28
2	USAF Men's Hands (1968)	3.90	3.94	4.00	4.07	4.18	4.33	4.51	4.67	4.76	4.92	5.04	1.14
3	US Army Aviators (1970)	3.83	3.89	3.97	4.04	4.16	4.30	4.45	4.60	4.69	4.79	4.86	1.03
4	USAF Basic Trainees (1965)	3.69	3.78	3.92	4.00	4.13	4.29	4.45	4.60	4.71	4.84	4.91	1.22
5	USAF Flying Pers. (1967)	3.79	3.85	3.92	3.99	4.11	4.26	4.41	4.55	4.63	4.70	4.75	0.96
6	USA Basic Trainees (1977)	3.70	3.78	3.86	3.94	4.09	4.25	4.41	4.53	4.61	4.72	4.76	1.06
7	USAF Flying Pers. (1950)	3.78	3.82	3.90	3.98	4.09	4.25	4.37	4.53	4.61	4.68	4.72	0.94
8	USA Basic Trainees (1966)	3.63	3.70	3.79	3.88	4.02	4.18	4.34	4.50	4.59	4.70	4.78	1.15
9	US Army Men (1966)	3.61	3.68	3.77	3.86	4.00	4.16	4.33	4.49	4.59	4.71	4.79	1.18
10	US Marine Corps (1966)	3.60	3.68	3.78	3.86	3.99	4.14	4.30	4.45	4.55	4.67	4.75	1.15
11	US Navy Recruits (1966)	3.54	3.61	3.70	3.79	3.92	4.08	4.23	4.37	4.46	4.57	4.64	1.10
12	USAF Women's Hands (1968)	3.37	3.41	3.49	3.58	3.72	3.88	4.03	4.17	4.27	4.40	4.51	1.14
13	US Army Women (1977)	3.45	3.49	3.56	3.63	3.75	3.88	4.03	4.16	4.24	4.33	4.40	0.95
14	Stewardess Trainees (1971)	3.29	3.36	3.45	3.54	3.68	3.83	3.98	4.11	4.18	4.27	4.32	1.03
15	USAF WAF Trainees (1952)	3.16	3.24	3.33	3.41	3.56	3.73	3.90	4.05	4.15	4.29	4.42	1.26

Table 14a. STATISTICAL VALUES FOR THUMB CROTCH LENGTH

No.	Series	N	Values in Inches				Range	Max.	Total	Stature ratio
			Mean	SE(M)	S.D.	V(%)				
1	US Army Men (1966)	6682	1.96	0.00	0.20	0.00	10.45	1.30	2.95	1.65
2	US Marine Corps (1966)	2008	1.96	0.00	0.21	0.00	10.87	1.22	2.72	1.50
3	US Navy Recruits (1966)	4095	1.95	0.00	0.19	0.00	9.95	0.98	2.64	1.66
4	USA Basic Trainees (1966)	2639	1.95	0.00	0.19	0.00	10.00	1.32	2.73	1.41

Table 14b. PERCENTILE VALUES FOR THUMB CROTCH LENGTH

No.	<u>Series</u>	Percentiles in Inches								Range <u>99th</u> - <u>1st-99th</u>			
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>				
1	US Marine Corps (1966)	1.50	1.54	1.61	1.69	1.82	1.96	2.10	2.23	2.32	2.42	2.50	1.00
2	US Army Men (1966)	1.50	1.55	1.63	1.70	1.82	1.95	2.09	2.22	2.30	2.39	2.46	0.96
3	US Navy Recruits (1966)	1.50	1.55	1.64	1.71	1.82	1.95	2.08	2.20	2.27	2.36	2.42	0.92
4	USA Basic Trainees (1966)	1.50	1.55	1.63	1.70	1.82	1.95	2.08	2.20	2.27	2.35	2.40	0.90

Table 15a. STATISTICAL VALUES FOR HAND BREADTH

No.	Series	N	Values in Inches				Range Min.	Range Max.	Total	Stature ratio
			Mean	SE(M)	S.D.	SE(SD)				
1	Law Enforcement Off. (1974)	2986	3.54	0.00	0.17	0.00	4.80	2.95	4.13	1.18
2	USAF Men's Hands (1968)	148	3.53	0.01	0.16	0.01	4.51	3.00	3.94	0.94
3	US Navy Aviators (1964)	1549	3.53	0.00	0.17	0.00	4.75	2.97	4.06	1.09
4	US Navy Recruits (1966)	4095	3.53	0.00	0.23	0.00	6.49	2.80	4.29	1.49
5	USA Basic Trainees (1977)	287	3.51	0.01	0.17	0.01	4.84	3.07	3.94	0.87
6	USAF Flying Pers. (1967)	2420	3.50	0.00	0.16	0.00	4.66	2.99	4.02	1.03
7	USA Basic Trainees (1966)	2639	3.50	0.00	0.18	0.00	5.18	2.85	4.22	1.37
8	US Army Men (1966)	6681	3.50	0.00	0.19	0.00	5.52	2.80	4.21	1.41
9	US Marine Corps (1966)	2038	3.49	0.00	0.17	0.00	4.98	3.03	4.29	1.26
10	USAF Basic Trainees (1965)	2527	3.49	0.00	0.19	0.00	5.44	2.89	4.14	1.25
11	US Army Aviators (1970)	1482	3.48	0.00	0.16	0.00	4.71	3.03	4.06	1.03
12	USAF Flying Pers. (1950)	4000	3.48	0.00	0.16	0.00	4.64	2.99	4.02	1.03
13	US Army Aviators (1959)	500	3.48	0.01	0.16	0.00	4.60	2.99	3.98	0.99
14	USAF Basic Trainees (1952)	3317	3.44	0.01	0.18	0.01	5.20	2.76	4.13	1.37
15	US Army Men (1946)	24,488	3.41	0.00	0.19	0.00	5.57	2.36	4.33	1.97

Table 15b. PERCENTILE VALUES FOR HAND BREADTH

No.	Series	Percentiles in Inches							Range <u>1st-99th</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>Median</u>	<u>90th</u>					
1	Law Enforcement Off. (1974)	3.15	3.20	3.26	3.33	3.43	3.54	3.64	3.75	3.82	3.90	3.94	0.79
2	US Navy Aviators (1964)	3.15	3.19	3.25	3.31	3.41	3.53	3.64	3.74	3.80	3.87	3.92	0.77
3	USAF Men's Hands (1968)	3.19	3.23	3.28	3.34	3.43	3.52	3.63	3.75	3.82	3.94	4.02	0.83
4	US Navy Recruits (1966)	3.05	3.10	3.17	3.24	3.36	3.51	3.68	3.84	3.92	4.02	4.07	1.02
5	USA Basic Trainees (1977)	3.15	3.19	3.27	3.31	3.39	3.50	3.62	3.74	3.82	3.94	4.02	0.87
6	US Army Men (1966)	3.07	3.12	3.20	3.26	3.37	3.50	3.63	3.75	3.83	3.93	3.99	0.92
7	USAF Flying Pers. (1967)	3.14	3.18	3.24	3.30	3.39	3.50	3.61	3.72	3.78	3.86	3.91	0.77
8	USA Basic Trainees (1966)	3.10	3.14	3.21	3.27	3.37	3.49	3.61	3.73	3.81	3.89	3.95	0.85
9	US Army Aviators (1959)	3.14	3.17	3.21	3.27	3.36	3.49	3.60	3.70	3.75	3.82	3.85	0.71
10	USAF Basic Trainees (1965)	3.05	3.10	3.18	3.24	3.35	3.48	3.61	3.73	3.80	3.87	3.92	0.87
11	US Marine Corps (1966)	3.13	3.16	3.21	3.27	3.37	3.48	3.60	3.72	3.78	3.86	3.91	0.78
12	US Army Aviators (1970)	3.14	3.16	3.22	3.27	3.37	3.48	3.59	3.69	3.76	3.83	3.89	0.75
13	USAF Flying Pers. (1950)	3.11	3.15	3.23	3.27	3.39	3.46	3.58	3.70	3.74	3.82	3.86	0.75
14	USAF Basic Trainees (1952)	3.04	3.08	3.15	3.21	3.32	3.45	3.55	3.66	3.73	3.82	3.88	0.84
15	US Army Men (1946)	2.95	3.01	3.09	3.16	3.28	3.41	3.55	3.67	3.75	3.83	3.88	0.93

Table 15a. STATISTICAL VALUES FOR HAND BREADTH (continued)

No.	Series	N	Mean	Values in Inches				Range	Total	Stature ratio
				SE(M)	S.D.	SE(SD)	V(Z)			
16	USAAF Cadets (1942)	2955	3.39	0.00	0.17	0.00	5.01	2.87	4.09	1.22
17	USAAF Gunners (1942)	582	3.37	0.01	0.17	0.00	5.04	2.83	3.86	1.03
18	VA Veterans (1970)	2110	3.26	0.00	0.16	0.00	4.76	2.80	3.98	1.18
19	Spanish-American Vets. (1959)	129	3.32	0.01	0.15	0.01	4.52			.050
20	WASP Pilots (1942)	440	3.10	0.00	0.10	0.00	3.23	2.56	3.46	0.90
21	US Army Women (1977)	1331	3.08	0.00	0.15	0.00	4.87	2.60	3.58	0.98
22	USAF Women's Hands (1968)	211	3.03	0.01	0.15	0.01	4.87	2.70	3.43	0.73
23	US Army Women (1946)	8113	3.03	0.00	0.20	0.00	6.57	2.48	3.90	1.42
24	USAF WAF Trainees (1952)	851	3.02	0.01	0.19	0.00	6.42	2.48	3.78	1.30
25	USAAF Nurses (1942)	142	3.00	0.01	0.10	0.01	3.33	2.56	3.31	0.75
26	USAF Women (1968)	1905	2.97	0.01	0.23	0.00	8.61	1.93	3.43	1.50
27	Stewardess Trainees (1971)	423	2.90	0.01	0.13	0.00	4.37	2.56	3.31	0.75

Table 15b. PERCENTILE VALUES FOR HAND BREADTH (continued)

No.	Series	Percentiles in Inches							Range 99th (1st-99th)				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>					
16	USAAF Cadets (1942)	3.04	3.08	3.14	3.19	3.29	3.39	3.51	3.62	3.68	3.76	3.82	0.78
17	USAAF Gunners (1942)	3.01	3.05	3.11	3.16	3.28	3.37	3.48	3.58	3.63	3.70	3.75	0.74
18	VA Veterans (1970)	2.95	2.99	3.07	3.15	3.23	3.35	3.46	3.54	3.62	3.66	3.70	0.75
19	Spanish-American Vets. (1959)	3.00	3.03	3.08	3.13	3.20	3.30	3.40	3.50	3.56	3.64	3.70	0.70
20	MASP Pilots (1942)	2.75	2.75	2.85	2.90	3.00	3.10	3.20	3.29	3.35	3.42	3.47	0.72
21	US Army Women (1977)	2.74	2.77	2.83	2.88	2.97	3.08	3.18	3.28	3.33	3.39	3.43	0.69
22	USAF Women's Hands (1968)	2.70	2.73	2.78	2.84	2.93	3.04	3.14	3.22	3.28	3.35	3.40	0.70
23	USAF WAF Trainees (1952)	2.61	2.66	2.72	2.78	2.89	3.01	3.14	3.26	3.36	3.48	3.56	0.95
24	US Army Women (1946)	2.63	2.68	2.75	2.80	2.89	3.00	3.14	3.30	3.40	3.53	3.62	0.99
25	USAAF Nurses (1942)	2.72	2.76	2.80	2.84	2.92	3.00	3.08	3.16	3.20	3.25	3.29	0.57
26	USAF Women (1968)	2.62	2.66	2.72	2.78	2.87	2.97	3.03	3.17	3.23	3.30	3.34	0.72
27	Stewardess Trainees (1971)	2.58	2.63	2.69	2.73	2.81	2.89	2.98	3.07	3.13	3.20	3.24	0.66

Table 16a. STATISTICAL VALUES FOR HAND BREADTH AT THROAT

No.	Series	Values in Inches						Range	Max.	Total	Stature ratio
		N	Mean	SE(N)	S.D.	SE(SD)	V(%)				
1	US Navy Aviators (1964)	1549	4.20	0.00	0.19	0.00	4.63	3.45	4.85	1.40	.050
2	USAF Basic Trainees (1952)	3316	4.12	0.01	0.25	0.01	6.07	3.19	5.04	1.85	.060
3	USAF Flying Pers. (1950)	4000	4.07	0.00	0.21	0.00	5.12	3.35	4.76	1.41	.059
4	USAF Flying Pers. (1967)	2420	4.01	0.00	0.20	0.00	4.86	3.39	4.84	1.45	.057
5	USAF USAF Trainees (1952)	844	3.61	0.01	0.23	0.01	6.39	2.95	4.21	1.26	.056

Table 16b. PERCENTILE VALUES FOR HAND BREADTH AT THUMB

No.	Series	Percentiles in Inches							Range <u>29th (1st-99th)</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>					
1	US Navy Aviators (1964)	3.74	3.80	3.88	3.95	4.07	4.19	4.33	4.45	4.52	4.59	4.64	0.90
2	USAF Basic Trainees (1952)	3.51	3.59	3.71	3.80	3.95	4.12	4.29	4.45	4.54	4.64	4.72	1.21
3	USAF Flying Pers. (1950)	3.58	3.66	3.74	3.82	3.94	4.06	4.21	4.33	4.41	4.53	4.57	0.99
4	USAF Flying Pers. (1967)	3.58	3.63	3.70	3.77	3.88	4.01	4.14	4.27	4.34	4.42	4.48	0.90
5	USAF WAF Trainees (1952)	3.08	3.14	3.24	3.32	3.47	3.62	3.77	3.90	3.99	4.08	4.14	1.06

Table 17a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE

No.	Series	N	Mean	SE(M)	S.D.	SE(SD)	V(%)	Min.	Range	Max.	Total	Statute
												ratio
1	US Marine Corps (1966)	2008	8.53	0.01	0.44	0.01	5.10	7.13	10.08	2.95	124	
2	US Army Men (1966)	6682	8.51	0.01	0.45	0.00	5.26	7.01	10.35	3.34	124	
3	USAF Men's Hands (1968)	148	8.50	0.03	0.35	0.02	4.17	7.76	9.61	1.85		
4	USA Basic Trainees (1966)	2639	8.50	0.01	0.44	0.01	5.19	7.15	10.29	3.14	124	
5	USAF Flying Pers. (1967)	2420	8.49	0.01	0.37	0.01	4.34	7.24	9.72	2.48	122	
6	USAF Basic Trainees (1952)	3311	8.46	0.01	0.58	0.01	6.89	4.72	12.60	7.88	123	
7	US Army Aviators (1959)	500	8.45	0.02	0.38	0.01	4.50	7.40	9.72	2.32	122	
8	Law Enforcement Off. (1974)	2985	8.44	0.01	0.40	0.01	4.74	7.09	10.94	3.85	120	
9	USAF Basic Trainees (1965)	2527	8.44	0.01	0.41	0.01	4.86	6.75	10.05	3.30	122	
10	US Navy Recruits (1966)	4095	8.43	0.01	0.43	0.00	5.04	7.09	10.04	2.95	122	
11	US Navy Aviators (1964)	1549	8.42	0.01	0.40	0.01	4.69	6.79	9.85	3.06	120	
12	US Army Aviators (1970)	1482	8.34	0.01	0.39	0.01	4.70	7.20	9.49	2.29	121	
13	USA Basic Trainees (1977)	287	8.31	0.02	0.39	0.02	4.69	7.13	9.45	2.32	121	

Table 17b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE

No.	Series	Percentiles in Inches								Range (1st-99th)			
		1st	2nd	5th	10th	25th	50th	75th	90th				
1	US Marine Corps (1966)	7.59	7.68	7.83	7.98	8.23	8.53	8.82	9.09	9.26	9.45	9.58	1.99
2	US Army Men (1966)	7.53	7.64	7.81	7.95	8.20	8.49	8.79	9.09	9.28	9.49	9.63	2.10
3	USA Basic Trainees (1966)	7.57	7.67	7.82	7.96	8.20	8.48	8.79	9.09	9.27	9.47	9.60	2.03
4	USAF Flying Pers. (1967)	7.65	7.75	7.89	8.01	8.23	8.48	8.73	8.97	9.11	9.26	9.35	1.70
5	USAF Men's Hands (1968)	7.64	7.72	7.88	8.06	8.26	8.47	8.73	8.98	9.09	9.25	9.37	1.73
6	USAF Basic Trainees (1965)	7.54	7.63	7.78	7.92	8.17	8.44	8.72	8.96	9.12	9.31	9.45	1.91
7	USAF Basic Trainees (1952)	7.28	7.46	7.67	7.84	8.12	8.42	8.74	9.02	9.23	9.65	10.02	2.74
8	US Navy Recruits (1966)	7.51	7.60	7.75	7.89	8.14	8.42	8.71	8.98	9.15	9.36	9.51	2.00
9	Law Enforcement Off. (1974)	7.49	7.60	7.77	7.92	8.15	8.42	8.69	8.96	9.10	9.28	9.42	1.93
10	US Army Aviators (1959)	7.55	7.65	7.82	7.95	8.20	8.42	8.71	8.95	9.09	9.23	9.33	1.78
11	US Navy Aviators (1964)	7.48	7.60	7.76	7.91	8.15	8.42	8.68	8.92	9.06	9.22	9.32	1.84
12	US Army Aviators (1970)	7.45	7.55	7.71	7.84	8.07	8.33	8.60	8.85	9.01	9.19	9.32	1.87
13	US Basic Trainees (1977)	7.44	7.52	7.68	7.83	8.07	8.31	8.58	8.82	8.98	9.17	9.29	1.85

Table 17a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE (continued)

No.	Series	N	Mean	Values in Inches				Range	Statue ratio		
				SE(M)	S.D.	SE(SD)	V(%)				
14	USAF WAF Trainees (1952)	851	7.48	0.02	0.46	0.01	6.14	5.51	10.63	5.12	.117
15	USAF Women's Hands (1968)	211	7.37	0.02	0.33	0.02	4.43	6.57	8.31	1.74	.115
16	US Army Women (1977)	1331	7.26	0.01	0.34	0.01	4.68	6.22	8.35	2.13	.113
17	USAF Women (1968)	1905	7.21	0.01	0.36	0.01	4.99	5.91	8.46	2.55	.113

Table 17b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE (continued)

No.	Series	Percentiles in Inches								Range <u>99th (1st-99th)</u>	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>		
14	USAF WAF Trainees (1952)	6.57	6.69	6.85	6.97	7.24	7.48	7.72	7.99	8.15	8.39
15	USAF Women's Hands (1968)	6.67	6.75	6.87	6.97	7.14	7.34	7.57	7.80	7.93	8.08
16	US Army Women (1977)	6.51	6.59	6.71	6.83	7.02	7.26	7.49	7.70	7.82	7.95
17	USAF Women (1968)	6.41	6.49	6.62	6.74	6.96	7.20	7.45	7.67	7.81	7.98

Table 18a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE AT THUMB

No.	Series	Values in Inches						Range	Stature	ratio	
		<u>N</u>	<u>Mean</u>	<u>SE(M)</u>	<u>S.D.</u>	<u>SE(SD)</u>	<u>V(Z)</u>	<u>Min.</u>	<u>Max.</u>	<u>Total</u>	
1	USAF Flying Pers. (1967)	242C	10.14	0.01	0.43	0.01	4.19	8.62	11.77	3.15	.145
2	US Navy Aviators (1964)	1549	10.03	0.01	0.44	0.01	4.41	8.68	11.51	2.83	.143
3	USAF Basic Trainees (1965)	2527	9.89	0.01	0.49	0.01	4.95	8.41	11.55	3.14	.143

Table 18b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE AT THUMB

<u>No.</u>	<u>Series</u>	Percentiles in Inches									<u>Range</u> <u>1st-90th</u>
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>28th</u>	
1. USAF Flying Pers. (1967)	9.21	9.32	9.47	9.60	9.84	10.12	10.42	10.71	10.87	11.04	11.14
2 US Navy Aviators (1964)	9.02	9.14	9.31	9.46	9.72	10.02	10.32	10.60	10.77	10.96	11.07
3 USAF Basic Trainees (1965)	8.76	8.89	9.09	9.27	9.57	9.89	10.22	10.52	10.70	10.92	11.07
											2.31

Table 19a. STATISTICAL VALUES FOR FIRST CIRCUIT-FERENCE

Table 190. PERCENTILE VALUES FOR FIST CIRCUMFERENCE

No.	Series	Percentiles in Inches								Range (1st-99th)			
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>				
1	USAF Men's Hands (1968)	10.36	10.52	10.76	10.96	11.29	11.66	12.02	12.35	12.54	12.81	12.92	2.56
2	USAF Flying Pers. (1950)	10.31	10.47	10.67	10.87	11.18	11.54	11.89	12.24	12.44	12.68	12.80	2.49
3	USAF Basic Trainees (1952)	9.84	10.12	10.39	10.59	10.94	11.30	11.67	12.09	12.28	12.51	12.72	2.88
4	USAF WAF Trainees (1952)	8.70	8.82	9.06	9.21	9.53	9.88	10.24	10.51	10.71	10.90	11.06	2.36
5	USAF Women's Hands (1968)	8.71	8.83	9.00	9.15	9.41	9.74	10.12	10.48	10.70	10.93	11.07	2.36

Table 20a. STATISTICAL VALUES FOR WRIST CIRCUMFERENCE

No.	Series	N	Mean	Values in Inches				Range Max.	Range Total	Stature ratio
				SE(M)	S.D.	SE(SD)	V(%)			
1	Air Control Trainees (1961)	680	6.93	0.02	0.45	0.01	6.47	5.8	8.8	3.0
2	USAF Flying Pers. (1967)	2420	6.92	0.01	0.36	0.01	5.23	5.9	8.2	2.3
3	USAF Men's Hands (1968)	148	6.89	0.03	0.37	0.02	5.39	5.9	7.9	2.0
4	USAF Basic Trainees (1952)	3326	6.87	0.01	0.40	0.01	5.83	5.5	9.1	3.6
5	USAF Flying Pers. (1950)	4,000	6.84	0.01	0.36	0.00	5.24	5.7	8.5	2.8
6	VA Veterans (1970)	2099	6.83	0.01	0.40	0.01	5.86	5.5	8.6	3.1
7	USAF Basic Trainees (1965)	2527	6.75	0.01	0.33	0.00	4.96	5.5	8.0	2.5
8	USA Basic Trainees (1966)	2639	6.73	0.01	0.34	0.00	4.99	5.8	8.1	2.3
9	US Army Men (1966)	6682	6.72	0.00	0.34	0.00	5.13	5.4	8.5	3.1
10	US Navy Aviators (1964)	1549	6.71	0.01	0.32	0.01	4.72	5.6	7.7	2.1
11	US Marine Corps (1966)	2008	6.70	0.01	0.32	0.01	4.74	5.8	7.7	1.9
12	US Army Men (1946)	24,391	6.70	0.00	0.40	0.00	5.97	5.3	8.3	3.0
13	US Navy Recruits (1966)	4095	6.68	0.01	0.34	0.00	5.12	5.5	7.9	2.4
14	US Army Aviators (1970)	1482	6.64	0.01	0.41	0.01	6.13	5.4	8.0	2.6

Table 20b. PERCENTILE VALUES FOR WRIST CIRCUMFERENCE

No.	Series	Percentiles in Inches								Range 29th (1st-99th)	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>		
1	USAF Flying Pers. (1967)	6.2	6.3	6.4	6.5	6.7	6.9	7.2	7.4	7.6	7.8 7.9 1.7
2	USAF Basic Trainees (1952)	6.1	6.2	6.3	6.4	6.6	6.9	7.2	7.4	7.6	7.8 7.9 1.8
3	USAF Men's Hands (1968)	6.1	6.2	6.3	6.4	6.6	6.9	7.1	7.4	7.5	7.7 7.8 1.7
4	Air Control Trainees (1961)	5.8	5.9	6.1	6.3	6.5	6.8	7.0	7.4	7.6	7.8 8.0 2.2
5	VA Veterans (1970)	6.1	6.2	6.3	6.4	6.6	6.8	7.0	7.3	7.5	7.7 7.9 1.8
6	USAF Flying Pers. (1950)	6.1	6.2	6.3	6.4	6.6	6.8	7.1	7.3	7.5	7.6 7.8 1.7
7	US Army Men (1946)	5.8	5.9	6.0	6.2	6.4	6.7	7.0	7.3	7.4	7.6 7.7 1.9
8	USAF Basic Trainees (1965)	6.0	6.1	6.2	6.3	6.5	6.7	7.0	7.2	7.3	7.5 7.6 1.6
9	USA Basic Trainees (1966)	6.0	6.1	6.2	6.3	6.5	6.7	6.9	7.2	7.3	7.5 7.6 1.6
10	US Army Men (1966)	5.9	6.0	6.2	6.3	6.5	6.7	6.9	7.2	7.3	7.5 7.6 1.7
11	US Navy Recruits (1966)	5.9	6.0	6.1	6.2	6.4	6.7	6.9	7.1	7.3	7.4 7.6 1.7
12	US Navy Aviators (1964)	6.0	6.1	6.2	6.3	6.5	6.7	6.9	7.1	7.2	7.4 7.5 1.5
13	US Marine Corps (1966)	6.0	6.1	6.2	6.3	6.5	6.7	6.9	7.1	7.2	7.4 7.5 1.5
14	US Army Aviators (1970)	5.8	5.9	6.0	6.1	6.4	6.6	6.9	7.2	7.4	7.6 7.7 1.9

Table 20a. STATISTICAL VALUES FOR WRIST CIRCUMFERENCE (continued)

No.	Series	N	Values in inches				Range	Stature			
			Mean	SE(M)	S.D.	SE(SD)					
15	USAF WAF Trainees (1952)	848	6.08	0.01	0.41	0.01	6.70	5.1	7.9	2.8	.095
16	USAF Women's Hands (1968)	211	5.90	0.02	0.28	0.01	4.75	5.2	6.7	1.5	.092
17	USAF Women (1968)	1905	5.89	0.01	0.28	0.00	4.75	4.9	6.9	2.0	.092
18	US Army Women (1977)	1331	5.79	0.01	0.27	0.01	4.66	5.1	6.9	1.8	.090
19	US Army Women (1946)	8112	5.79	0.00	0.32	0.00	5.53	4.5	7.2	2.7	.091
20	Stewardess Trainees (1971)	422	5.39	0.01	0.27	0.01	5.06	4.6	6.3	1.7	.082

Table 20b. PERCENTILE VALUES FOR WRIST CIRCUMFERENCE (continued)

No.	Series	Percentiles in Inches								Range (1st-99th)			
		1st	2nd	5th	10th	25th	50th	75th	90th				
15	USAF WAF Trainees (1952)	5.4	5.4	5.5	5.6	5.8	6.0	6.3	6.6	6.9	7.1	7.3	1.9
16	USAF Women (1968)	5.3	5.3	5.4	5.5	5.7	5.9	6.1	6.3	6.4	6.5	6.6	1.3
17	USAF Women's Hands (1968)	5.3	5.4	5.4	5.5	5.7	5.9	6.1	6.3	6.4	6.5	6.6	1.3
18	US Army Women (1946)	5.1	5.2	5.3	5.4	5.6	5.8	6.0	6.2	6.4	6.5	6.7	1.6
19	US Army Women (1977)	5.2	5.3	5.4	5.5	5.6	5.8	6.0	6.1	6.2	6.3	6.4	1.2
20	Stewardess Trainees (1971)	4.8	4.9	5.0	5.1	5.2	5.4	5.6	5.8	5.9	6.0	6.0	1.2

Table 21a. STATISTICAL VALUES FOR HAND THICKNESS<sup>a</sup>

No.	Series	Values in Inches						Range	Stature ratio
		N	Mean	SE(M)	S.D.	SE(SD)	V(%)		
1	USAF Men's Hands (1968)	148	1.29	0.01	0.08	0.00	5.99	1.10	1.46
2	US Navy Aviators (1964)	1549	1.22	0.00	0.08	0.00	6.69	0.85	1.58
3	USAF Basic Trainees (1952)	2019	1.19	0.01	0.09	0.01	7.65	0.79	1.57
4	USAF Flying Pers. (1950)	4000	1.17	0.00	0.07	0.00	5.72	0.94	1.42
5	USAF Basic Trainees (1965)	2527	1.17	0.00	0.08	0.00	6.48	0.85	1.51
6	USAF Flying Pers. (1967)	2420	1.09	0.00	0.08	0.00	7.56	0.79	1.42
7	USAF Women's Hands (1968)	211	1.09	0.00	0.07	0.00	6.41	0.94	1.30
8	USAF WAF Trainees (1952)	850	0.97	0.00	0.09	0.00	9.60	0.75	1.42

<sup>a</sup>Thickness of knuckle (metacarpal-first phalanx joint) of middle finger.

Table 21b. PERCENTILE VALUES FOR HAND THICKNESS<sup>a</sup>

No.	Series	Percentiles in Inches							Range 1st-99th				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u> Median	<u>75th</u>					
1	USAF Men's Hands (1968)	1.15	1.15	1.17	1.19	1.23	1.30	1.35	1.39	1.42	1.42	1.46	0.31
2	US Navy Aviators (1964)	1.06	1.07	1.10	1.13	1.17	1.22	1.27	1.33	1.37	1.42	1.46	0.40
3	USAF Basic Trainees (1952)	0.98	1.01	1.05	1.09	1.14	1.20	1.26	1.31	1.35	1.40	1.43	0.45
4	USAF Flying Pers. (1950)	0.98	1.02	1.06	1.10	1.14	1.18	1.22	1.26	1.30	1.34	1.34	0.36
5	USAF Basic Trainees (1965)	0.98	1.00	1.03	1.06	1.11	1.17	1.22	1.28	1.31	1.34	1.37	0.39
6	USAF Flying Pers. (1967)	0.87	0.91	0.95	0.99	1.04	1.09	1.14	1.19	1.23	1.27	1.30	0.43
7	USAF Women's Hands (1968)	0.94	0.94	0.97	0.99	1.04	1.09	1.14	1.18	1.20	1.23	1.26	0.32
8	USAF WAF Trainees (1952)	0.81	0.82	0.84	0.86	0.90	0.96	1.03	1.09	1.14	1.19	1.23	0.42

<sup>a</sup>Thickness of knuckle (metacarpal-first phalanx joint) of middle finger.

## 8. SUMMARY OF HAND DATA

From the standpoint of comparisons, the anthropometric data on hands presented in the previous tables may be summarized here. The basic hand measurements, including Hand Length, Palm Length, Hand Breadth and Hand Circumference, will be discussed in terms of variation in hand size and proportions.

### a. Hand Length

Hand length is measured as the overall length of the hand from the wrist crease to the tip of the middle finger. Mean values for hand length among samples of U.S. men range from 18.82 cm (7.41 in.) up to 19.72 cm (7.76 in.). The data presented here show that minimum hand length is 14.9 cm (5.87 in.) and maximum hand length is 23.8 cm (9.38 in.), giving an overall range of 8.9 cm (3.51 in.) for the hand length of U.S. men. As shown by the stature ratios, the mean hand lengths of U.S. men are about eleven percent of their mean statures. The lowest 1st percentile value for men's hand length is 16.8 cm (6.62 in.), while the highest 99th percentile value is 22.3 cm (8.78 in.). A range or spread of 5.5 cm (2.16 in.) would include 98 percent of the hand lengths of U.S. men.

Mean values of hand length for U.S. women all are lower than those for men, ranging from a low mean of 17.17 cm (6.76 in.) up to a high mean of 18.38 cm (7.24 in.). Minimum hand length for U.S. women is 14.5 cm (5.71 in.) and maximum hand length is 22.0 cm (8.66 in.); thus the overall range of hand length for U.S. women is 7.5 cm (2.95 in.). The mean hand lengths for U.S. women also are about eleven percent of their mean statures. The lowest 1st percentile value for the hand length of U.S. women is 15.3 cm (6.03 in.) and the highest 99th percentile value is 20.8 cm (8.17 in.); thus a range of 5.5 cm (2.16 in.) would include 98 percent of U.S. women's hand lengths, as is the case with men.

### b. Palm Length

Mean values of palm length among samples of U.S. men range from 10.35 cm (4.08 in.) up to 11.54 cm (4.54 in.). Minimum palm length is 7.3 cm (2.87 in.) and maximum palm length is 13.8 cm (5.44 in.), giving an overall range of 6.5 cm (2.57 in.) for men's palm lengths. The mean palm lengths of U.S. men are about six percent of their mean statures. The lowest 1st percentile value for men's palm length is 9.0 cm (3.54 in.) and the highest 99th percentile value is 13.3 cm (5.23 in.); thus a range of 4.3 cm (1.69 in.) would include 98 percent of the palm lengths of U.S. men.

Mean values of palm length for U.S. women also are lower than those for men, ranging from 9.50 cm (3.74 in.) up to 9.88 cm (3.89 in.). Minimum palm length is 7.4 cm (2.91 in.) and maximum palm length is 11.8 cm (4.65 in.), giving an overall range of 4.4 cm (1.74 in.) for women's palm length. The mean palm lengths of U.S. women also are about six percent of their mean statures. The lowest 1st percentile value for women's palm length is 8.0 cm (3.16 in.) and the highest 99th percentile value is 11.5 cm (4.51 in.); thus a range of 3.5 cm (1.35 in.) would include 98 percent of the palm lengths for U.S. women.

Palm length represents the length of the hand less the fingers. The relative proportion of palm length to hand length may be expressed by an index obtained by dividing the value of palm length by the value for hand length. This index ranges from 54.8 up to 56.8, indicating that in terms of proportions, palm length is from 54.8 percent to 56.8 percent of hand length. This index also indicates that the length of the middle finger (the longest finger of the hand) represents from 45.2 to 43.2 percent of hand length. Thus a low palm length index represents a relatively short palm and long fingers, while a higher index indicates a longer palm and shorter fingers. Most palm length indices are between 55 and 57 percent of hand length for U.S. men and women. There appear to be no particular differences or distinctions between men's and women's hands on the basis of the values of the palm length index.

#### **c. Hand Breadth**

Hand breadth is the breadth of the hand measured at the level of the knuckles (metacarpal-phalangeal joints). Mean values for hand breadth among samples of U.S. men range from 8.43 cm (3.32 in.) up to 8.99 cm (3.54 in.). Minimum hand breadth is 6.0 cm (2.36 in.) and maximum hand breadth is 11.0 cm (4.33 in.), giving an overall range of 5.0 cm (1.97 in.) for the hand breadth of U.S. men. The mean hand breadths of U.S. men are about five percent of their mean statures. The lowest 1st percentile value for men's hand breadth is 7.5 cm (2.95 in.), while the highest 99th percentile value is 10.3 cm (4.07 in.). A range of 2.8 cm (1.12 in.) would include 98 percent of the hand breadths of U.S. men.

Mean values of hand breadth for U.S. women also are lower than those for men, ranging from 7.37 cm (2.90 in.) up to 7.82 cm (3.08 in.). Minimum hand breadth is 6.1 cm (1.93 in.) and maximum hand breadth is 9.9 cm (3.90 in.), giving an overall range of 3.8 cm (1.97 in.) for women's hand breadths. The mean hand breadths of U.S. women are about 4.7 percent of their mean statures. The lowest 1st percentile value for the hand breadth of U.S. women is 6.6 cm (2.58 in.) and the highest 99th percentile value is 9.2 cm (3.62 in.); thus a range of 2.6 cm (1.04 in.) would include 98 percent of the hand breadths of U.S. women.

The general proportions of the hand are indicated by the hand index which shows the relationship between hand breadth and hand length. The hand index, obtained by dividing the value for hand breadth by the value for hand length, ranges between 44.8 and 47.4 for U.S. men, indicating that hand breadth is between 44.8 and 47.4 percent of hand length. A low index indicates a narrow hand in proportion to hand length, while a high index represents a broad hand relative to hand length. Most samples of U.S. men have hand indices of 46 or 47 percent. The hand index for U.S. women ranges between 41.1 and 44.8 percent; in most samples of U.S. women, the hand index is between 42.5 and 44.6 percent.

#### **d. Hand Circumference**

Hand circumference is the girth of the hand measured at the level of the knuckles (metacarpal-phalangeal joints). This is an important measurement of the hand, since it is used as the primary basis for the sizing of handwear. Mean values for hand circumference among samples of U.S. men range from 21.11 cm (8.31 in.) up to 21.68 cm (8.53 in.). The data presented here show that minimum hand circumference is 17.2 cm (6.75 in.) and maximum

hand circumference is 27.8 cm (10.84 in.), giving an overall range of 10.6 cm (4.19 in.) for the hand circumferences of U.S. men. (Minimum and maximum values of 12.0 cm and 32.0 cm for the hand circumferences of USAF Basic Trainees (1952), as shown in Table 7a, are questionable). Mean hand circumferences of U.S. men are about twelve percent of their mean statures. The lowest 1st percentile value for men's hand circumference is 18.5 cm (7.28 in.), while the highest 99th percentile value is 25.5 cm (10.02 in.). Thus a range of 7.0 cm (2.74 in.) would include 98 percent of the hand circumferences of U.S. men.

Mean values of hand circumference for U.S. women all are lower than those of U.S. men, ranging from 18.32 cm (7.21 in.) up to 18.99 cm (7.48 in.). Minimum hand circumference for U.S. women is 14.0 cm (5.51 in.) and maximum hand circumference is 27.0 cm (10.63 in.), giving an overall range of 13.0 cm (5.12 in.) for the hand circumferences of U.S. women. The mean hand circumferences for U.S. women are about 11.5 percent of their mean statures. The lowest 1st percentile value for the hand circumference of U.S. women is 16.3 cm (6.41 in.) and the highest 99th percentile value is 21.8 cm (8.58 in.). Thus a range of 5.5 cm (2.17 in.) would include 98 percent of the hand circumferences of U.S. women.

The proportion of hand circumference to hand length is indicated by an index obtained by dividing the value for hand circumference by the value for hand length. Since the hand circumference measurement usually is greater than hand length, this index will be above 100 percent. The hand circumference/hand length index for U.S. men ranges between 109.0 and 114.5 percent. A low index indicates a slender or thin hand relative to length, while a higher index represents a heavy or thick hand in proportion to length. This index ranges between 99.7 percent and 110.6 percent for U.S. women as a reflection of generally more slender women's hands. In the case of U.S. Air Force women (1968), mean hand circumference is slightly less than mean hand length, so that the hand circumference/hand length index drops slightly below 100 percent for this sample of women.

## 9. U.S. ARMY DATA ON MEN'S AND WOMEN'S HANDS

### a. Comparative Anthropometric Data

Comparative anthropometric data on the hands of U.S. Army men and women are presented and discussed in detail in this section, primarily since the raw data on hand measurements were readily available for use in a computer program for the generation of bivariate tables.

The first reason for a detailed analysis of hand data on both men and women is that the increasing numbers and importance of women in the U.S. Army emphasizes the need for more information on the anthropometry of women. Women in the Army still have and use much of their own distinctive military clothing and equipment. However, the use by women of items of clothing and equipment initially designed and sized for men is increasing. As a consequence, some situations have developed where the men's items are not satisfactory for women from the standpoint of design and sizing. In the case of handwear, this requires analyses of the comparative anthropometric data on the hands of both men and women.

A second reason for the detailed presentation of hand data for men and women is that, for purposes of design and sizing, more than one dimension is required. In the case of handwear, for example, information is needed on both hand circumference and hand length for sizing purposes. The ranges of variation shown by the two hand dimensions must be considered together. In other words, the interrelationships between two dimensions must be examined in order to provide a more meaningful description of the situation as values of both dimensions increase from small to large. This may be accomplished by means of bivariate tables which show the interrelationships between two dimensions. Since comparative anthropometric data on the hands now are available for both U.S. Army men and women, these data will be presented in the form of bivariate tables for hand measurements.

### b. Summary Tables of Anthropometric Data

Anthropometric data are available for U.S. Army men from a survey conducted in 1966, in which 6682 Army men were measured. Data on women are available from an anthropometric survey of 1330 Army women, carried out in 1977. Four basic hand measurements were included in these two surveys: Hand Length, Palm Length, Hand Breadth, and Hand Circumference. The anthropometric data on the hands of both men and women are summarized in Table 22 in centimeters and in Table 23 in inches. Statistical values are shown in Tables 22a and 23a, while selected percentile values are given in Tables 22b and 23b. In addition, statistical and percentile values for a combined series of 8012 men and women also are shown in these summary tables.

The data in the summary tables indicate that the sizes of men's hands are larger than those of women for all four basic hand dimensions. Mean Hand Length is 1.59 cm (0.62 in.) less for women; mean Palm Length is 0.71 cm (0.28 in.) less for women; mean Hand Breadth is 1.08 cm (0.42 in.) less for women; and mean Hand Circumference is 3.16 cm (1.25 in.) less for women than for men. The women's sample of hands also shows lower standard deviations and lower ranges (from small to large) than men in all hand dimensions. A comparison

Table 22a. STATISTICAL VALUES FOR HAIR MEASUREMENTS OF U. S. ARMY MEN AND WOMEN

No.	Measurements	N	Values in Centimeters				Range	Stature ratio			
			Mean	SE(1)	S.D.	SE(2)	Min.	Max.	Total		
1	Hand Length										
	U. S. Army Men (1966)	6682	19.03	0.01	0.96	0.01	15.5	23.5	8.0	.109	
	U. S. Army Women (1977)	1330	17.44	0.02	0.90	0.02	14.9	20.4	5.5	.107	
	Combined Men and Women	8012	18.77	0.01	1.12	0.01	14.9	23.5	8.6	.109	
2	Palm Length										
	U. S. Army Men (1966)	6682	10.59	0.01	0.63	0.01	5.93	8.1	13.3	5.2	.061
	U. S. Army Women (1977)	1330	9.58	0.01	0.52	0.01	5.29	8.2	11.6	3.4	.061
	Combined Men and Women	8012	10.48	0.01	0.67	0.01	6.37	8.1	13.3	5.2	.061
3	Hand Breadth										
	U. S. Army Men (1966)	6682	8.90	0.01	0.49	0.00	5.52	7.1	10.7	3.6	.051
	U. S. Army Women (1977)	1330	7.82	0.01	0.39	0.01	4.97	6.6	9.1	2.5	.048
	Combined Men and Women	8011	8.72	0.01	0.62	0.00	7.14	6.6	10.7	4.1	.051
4	Hand Circumference										
	U. S. Army Men (1966)	6682	21.61	0.01	1.14	0.01	5.26	17.8	26.3	3.5	.124
	U. S. Army Women (1977)	1330	18.45	0.02	0.86	0.02	4.64	15.8	21.2	5.4	.113
	Combined Men and Women	8012	21.08	0.02	1.61	0.01	7.62	15.6	26.3	16.5	.122

Table 22b. PERCENTILE VALUES FOR HAND MEASUREMENTS OF U. S. ARMY MEN AND WOMEN

No.	Measurements	Percentiles in Centimeters						Range <u>1st-99th</u>			
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>95th</u>	<u>99th</u>
1	Hand Length										
	U. S. Army Men (1966)	16.9	17.2	17.5	17.8	18.4	19.0	19.6	20.3	21.1	21.4
	U. S. Army Women (1977)	15.5	15.7	16.1	16.3	16.8	17.4	18.0	18.7	19.4	19.6
	Combined Men and Women	16.1	16.4	16.9	17.3	18.0	18.8	19.5	20.2	21.0	21.4
2	Palm Length										
	U. S. Army Men (1966)	9.2	9.3	9.6	9.8	10.2	10.6	11.0	11.4	11.7	12.0
	U. S. Army Women (1977)	8.8	8.9	9.0	9.2	9.5	9.9	10.2	10.6	10.8	11.0
	Combined Men and Women	9.0	9.2	9.4	9.6	10.0	10.5	10.9	11.4	11.6	11.9
3	Hand Breadth										
	U. S. Army Men (1966)	7.8	7.9	8.1	8.3	8.6	8.9	9.2	9.5	9.7	10.0
	U. S. Army Women (1977)	7.0	7.0	7.2	7.2	7.6	7.8	8.1	8.3	8.5	8.6
	Combined Men and Women	7.2	7.4	7.6	7.9	8.3	8.8	9.2	9.5	9.7	9.9
4	Hand Circumference										
	U. S. Army Men (1966)	19.1	19.4	19.8	20.2	20.8	21.6	22.3	23.1	23.6	24.1
	U. S. Army Women (1977)	16.5	16.7	17.0	17.3	17.8	18.4	19.0	19.6	19.9	20.2
	Combined Men and Women	17.0	17.4	18.1	18.8	20.1	20.3	22.2	22.9	23.4	24.0

Table 23a. STATISTICAL VALUES FOR HAND MEASUREMENTS OF U. S. ARMY MEN AND WOMEN

No.	Measurements	N	Mean	SE( $\bar{X}$ )	S.D.	SE( $S_D$ )	$V(S_D)$	Values in inches			Range	Stature	ratio
								Min.	Max.	Total			
1	Hand Length												
	U. S. Army Men (1966)	6682	7.49	0.00	0.38	0.00	5.06	6.10	9.25	3.15	.109		
	U. S. Army Women (1977)	1330	6.87	0.01	0.35	0.01	5.17	5.87	8.03	2.16	.107		
	Combined Men and Women	8012	7.39	0.00	0.44	0.00	5.98	5.87	9.25	3.38	.109		
2	Palm Length												
	U. S. Army Men (1966)	6682	4.17	0.00	0.25	0.00	5.93	3.19	5.24	2.05	.061		
	U. S. Army Women (1977)	1330	3.89	0.01	0.21	0.00	5.29	3.23	4.57	1.34	.061		
	Combined Men and Women	8012	4.12	0.00	0.26	0.00	6.37	3.19	5.24	2.05	.061		
3	Hand Breadth												
	U. S. Army Men (1966)	6681	2.50	0.00	0.19	0.00	5.52	2.80	4.21	1.41	.051		
	U. S. Army Women (1977)	1330	2.68	0.00	0.15	0.00	4.97	2.60	3.58	0.98	.048		
	Combined Men and Women	8011	2.43	0.00	0.25	0.00	7.14	2.60	4.21	1.61	.051		
4	Hand Circumference												
	U. S. Army Men (1966)	6682	8.51	0.01	0.45	0.00	5.26	7.01	10.35	3.34	.124		
	U. S. Army Women (1977)	1330	7.26	0.01	0.34	0.01	4.64	6.22	8.35	2.13	.113		
	Combined Men and Women	8012	8.30	0.01	0.63	0.00	7.62	6.22	10.35	4.13	.122		

Table 23. PERCENTILE VALUES FOR HAND MEASURES OF U. S. ARMY MEN AND WOMEN

No.	Measurement <sup>3</sup>	Percentiles in Inches							Range 1st-99th
		1st	2nd	5th	10th	25th	50th	75th	
1	Hand Length								
	U. S. Army Men (1966)	6.56	6.75	6.90	7.02	7.23	7.48	7.74	8.13
	U. S. Army Women (1977)	6.10	6.19	6.32	6.43	6.62	6.84	7.10	7.35
	Combined Men and Women	6.33	6.45	6.64	6.81	7.10	7.40	7.69	8.09
2	Palm Length								
	U. S. Army Men (1966)	3.61	3.68	3.77	3.86	4.00	4.16	4.33	4.59
	U. S. Army Women (1977)	3.37	3.41	3.49	3.58	3.72	3.88	4.03	4.17
	Combined Men and Women	3.53	3.60	3.70	3.79	3.94	4.12	4.30	4.57
3	Hand Breadth								
	U. S. Army Men (1966)	3.07	3.12	3.20	3.26	3.37	3.50	3.63	3.75
	U. S. Army Women (1977)	2.74	2.77	2.83	2.88	2.97	3.08	3.18	3.28
	Combined Men and Women	2.84	2.89	3.00	3.10	3.27	3.45	3.60	3.73
4	Hand Circumference								
	U. S. Army Men (1966)	7.55	7.54	7.81	7.95	8.20	8.49	8.79	9.09
	U. S. Army Women (1977)	6.51	6.59	6.71	6.83	7.02	7.26	7.49	7.70
	Combined Men and Women	6.71	6.84	7.12	7.41	7.90	8.38	8.75	9.00

of the percentile values for men's and women's hands also shows the values for men to be greater. As might be expected, the values shown for the hand dimensions of the combined series of men and women are intermediate, falling between the values for men alone and values for women alone.

### c. Bivariate Tables of Anthropometric Data

Bivariate tables for the four basic hand dimensions have been developed through the use of a new computer program, based on files of anthropometric data for men and women. Since each of the four hand measurements is shown in a bivariate table with the other three measurements, there are six basic bivariate combinations of hand measurements. These are: Hand Circumference vs. Hand Length, Palm Length, and Hand Breadth; Hand Length vs. Palm Length and Hand Breadth; and Palm Length vs. Hand Breadth. Bivariate tables are given for men, for women, and for the combined series of both men and women. The bivariate tables are presented in centimeters (Tables 24 - 41) and in inches (Tables 42 - 59), making a total of 36 bivariate tables for the four hand dimensions.

In the bivariate tables shown in centimeters, the range of each hand dimension is divided into intervals of one centimeter, while in the bivariate tables given in inches, intervals of one-half inch are used. The upper line within each box of the bivariate table shows the frequency or number of individuals in that category, while the lower line within each box indicates the percentage of the total sample in that category. Thus in Table 24, for example, showing Hand Circumference plotted against Hand Length for 6682 U.S. Army men, 940 men have Hand Circumferences between 21.0 and 22.0 cm and Hand Lengths between 18.0 and 19.0 cm. These 940 men represent 14.1 percent of the total sample of 6682 men. The total number of individuals and the percentages for each interval of Hand Circumference are shown to the right of the table, while the total number of individuals and the percentages for each interval of Hand Length are given at the bottom of the bivariate table.

The bivariate tables showing data on men's hand measurements are based on a series of 6682 U.S. Army men, while the bivariate tables giving data on women's hand measurements are based on a series of 1330 U.S. Army women. The same range of intervals has been used in both the men's and women's bivariate tables. Thus it may be seen that in the men's bivariate, the distribution tends to cluster in the upper right hand part of the bivariate table, indicating the larger dimensions of the men's hands. In the women's bivariate, however, the distribution tends to cluster in the lower left hand part of the bivariate, indicating the somewhat smaller dimensions of the women's hands.

In the bivariate tables for both men and women, the data on 6682 and 1330 women have been combined, giving a total sample of 8012 individuals. It may be noted that the distribution shown in the combined bivariate is not a bimodal distribution, but rather is an even distribution throughout the total range of intervals in the bivariate. This combined sample of U.S. Army men and women consists of about 83 percent (6682) men and 17 percent (1330) women. This sample of Army men and women may be compared with the approximate total Army strength figures (as of 1980) of 91.5 percent (698,000) men and 8.5 percent (65,000) women. It is anticipated, however, that the number of women in the Army probably will be increased.

The bivariate table indicates the spread or range for two hand measurements. It also gives the frequency and percentage of individuals within each category or box in the bivariate, based on intervals of the two hand measurements. Finally, the bivariate table also depicts the interrelationship between the two hand measurements; as one measurement increases in size, the other hand measurement also increases.

The primary usefulness of the bivariate table as a format for the presentation of anthropometric data lies in its utilization in design and sizing. The bivariate table of Hand Circumference and Hand Length, for example, forms the basis for the sizing of gloves and other handwear. An even more significant use of the bivariate table is in the development of tariffs for handwear; that is the listing of the quantity or number of each size of handwear required for a given population. The development of tariffs for handwear will be discussed in Section 11. HANDS AND HANDWEAR (page 159).

#### **d. Coefficients of Correlation**

The bivariate table shows how two measurements are interrelated. The degree of interrelationship between two variables, in this case two hand measurements, is indicated by a statistic known as the coefficient of correlation (often called the "r" value). The correlation coefficient may have values between 0 and 1. A low value indicates a low or poor correlation between two measurements, while a high value indicates a good or high correlation between the two measurements. Correlation coefficients may be positive or negative. A positive correlation indicates that as the value of one measurement increases, the value of the other measurement also increases, while a negative correlation shows that as the value of one measurement increases, the value of the other measurement decreases. Coefficients of correlation among the four basic hand measurements are shown in Table 60 (page 133), following the bivariate tables. Coefficients of correlation are given for the hand measurements of U.S. Army men, of U.S. Army women, and of men and women combined. The correlation coefficients for the men's hand data are slightly lower than those based on the women's data. However, all of these coefficients of correlation are positive.

#### **e. Regression Equations**

Another biproduct of the bivariate table is the regression equation, which provides a further indication of the interrelationship between the two measurements shown in the bivariate table. By means of the regression equation, it is possible to predict the value of one hand measurement from a known value of the other hand measurement. Although regression equations usually are presented with each bivariate table, the format used here for the bivariate tables does not provide sufficient space on the page for this. Consequently, the regression equations for hand measurements are shown separately in Tables 61 and 62 (pages 134-137), following the bivariate tables.

Regression equations for values in centimeters are given in Table 61, while regression equations for values in inches are shown in Table 62. In each table, regression equations are given for six pairs of hand measurements. The regression equations also are shown for the hand measurement data for U.S. Army men (1966), for U.S. Army women (1977), and for a combined sample of both men and women.

As an example, Hand Length for U.S. Army men may be predicted from the second regression equation given in Table 61:

$$\text{Hand Length} = (0.42) * \text{Hand Circumference} + (9.93)$$

(The \* sign is the symbol for multiplication in Fortran computer language).

For men with a Hand Circumference of 22.0 cm, the solution of this equation gives the following:

$$\begin{aligned}\text{Hand Length} &= (0.42) * 22.0 + (9.93) \\ &= 9.24 + 9.93 \\ &= 19.17 \text{ cm}\end{aligned}$$

Thus, a Hand Circumference of 22.0 cm for men will have a predicted value of 19.17 cm for Hand Length.

Conversely, Hand Circumference may be predicted from a known value of Hand Length through the use of the first regression equation shown in Table 61.

Values of hand measurements for U.S. Army men, for U.S. Army women, or for a combined sample of both men and women thus may be calculated in either centimeters or in inches through the use of the regression equations given in Tables 61 and 62 for the six pairs of basic hand measurements.

The solution of a regression equation provides a predicted value for a hand measurement. This value, however, may be considered to be only an "average" value. Each regression equation given in Tables 61 and 62 is followed by a statistic known as the standard error of estimate; this is a measure of variability somewhat similar to the standard deviation. Use of the standard error of estimate, together with the predicted value of a hand measurement, provides an indication of the variability of that measurement. Essentially, two-thirds of the individuals in a sample will have values of a hand dimension between limits represented by the predicted value minus and plus one standard error; 95 percent will have values between the predicted value minus and plus two standard errors of estimate.

Table 24. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH  
FOR U. S. ARMY MEN (1966)

HAND LENGTH														
Centimeters														
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent	
	:	:	:	:	:	:	:	1	2	2	1	6		
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	:	.0	.0	.0	.0	.0	.0	
	27.0													
	:	:	:	:	:	:	1	2	2	1	6			
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	.0	.0	.0	.0	.0			
	26.0						1	1	8	11	5	26		
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	.0	.0	.1	.2	.1	.4		
	25.0						1	23	45	49	22	3	145	
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	.0	.3	.7	.7	.3	.0	.22	
	24.0						1	11	109	264	187	44	3	633
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	.0	.2	1.6	4.0	2.8	.7	.0	.95
	H	A	N	U	C	E	23.0							
	:	:	:	:	:	:	3	80	447	729	382	42	5	1688
	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	.0	1.2	6.7	10.9	5.7	.6	.1	25.3
	I	n	R	C	U	22.0								
	:	:	:	:	:	10	214	940	849	215	29	2	2259	
	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	.1	3.2	14.1	12.7	3.2	.4	.0	33.8	
	M	e	F	E	U	21.0								
	:	:	:	:	:	36	310	728	377	66	2	:	1519	
	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	.5	4.6	10.9	5.6	1.0	.0	:	22.7	
	R	e	R	E	S	20.0								
	:	:	:	:	:	18	115	156	65	3	1	:	358	
	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	.3	1.7	2.3	1.0	.0	.0	:	5.4	
	C	E	19.0											
	:	:	2	6	23	15	:	:	:	:	:	46		
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	.0	.1	.3	.2	:	:	:	:	:	.7		
	18.0													
	:	:	1	:	:	1	:	:	:	:	:	2		
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	.0	:	:	.0	:	:	:	:	:	.0		
	17.0													
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	:	:	:	:	:			
	16.0													
	:	:	:	:	:	:	:	:	:	:	:			
	:	:	:	:	:	:	:	:	:	:	:			
	15.0													
	:	:	:	:	:	:	:	:	:	:	:			
	Totals		3	74	755	2420	2338	915	147	25	5	6682		
	Percent		.0	1.0	11.3	36.2	35.0	13.7	2.2	.4	.1		100.0%	

Table 25. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH  
FOR U. S. ARMY WOMEN (1977)

		HAND LENGTH													
		Centimeters													
		14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent	
H A N D C I R C U M E F E R E N C E	27.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	26.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	25.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	24.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	23.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	22.0	:	:	:	:	1	2	1	1	:	:	:	5		
	21.0	:	:	2	9	22	17	2	:	:	:	:	52		
	20.0	:	:	2	7	1.7	1.3	2	:	:	:	:	324	3.9	
	19.0	:	1	25	128	130	39	1	:	:	:	:	569	24.4	
	18.0	:	6	152	276	114	20	1	:	:	:	:	42.8		
	17.0	:	1	30	153	128	17	2	:	:	:	:	331	24.9	
	16.0	:	1	2.3	11.5	9.6	1.3	2	:	:	:	:	43		
	15.0	:	1	1.1	1	1	1	1	:	:	:	:	1	3.6	
Totals		1	48	359	552	286	79	5	:	:	:	:	1330		
Percent		.1	3.6	27.0	41.5	21.5	5.9	.4					100.0%		

Table 26. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH  
FOR U. S. ARMY MEN AND WOMEN

		HAND LENGTH												
		Centimeters												
		14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent
H A N D C e n t R i c U m e F e R e L N C E	27.0	:	:	:	:	:	:	1	2	2	1	:	6	
	26.0	:	:	:	:	:	:	:	:	:	:	:	0	
	25.0	:	:	:	1	1	8	11	5	:	:	26		
	24.0	:	:	:	0	0	1	1	1	1	1	2	145	
	23.0	:	:	1	23	45	49	22	3	2	1	1	633	
	22.0	:	:	0	3	6	6	3	0	0	0	0	1.8	
	21.0	:	:	0	1.0	1.4	3.3	2.3	5	2	0	0	7.9	
	20.0	:	:	3	80	447	729	382	42	5	1	1	1628	
	19.0	:	:	0	1.0	5.6	9.1	4.8	5	1	1	1	21.1	
	18.0	:	:	10	215	942	850	216	29	2	1	1	2264	
	17.0	:	:	1	2.7	11.8	10.6	2.7	4	0	0	0	28.3	
	16.0	:	:	38	319	750	394	68	2	1	1	1	1571	
	15.0	:	:	5	4.0	9.4	4.9	8	0	0	0	0	19.6	
	Totals	:	1	43	243	286	104	4	1	1	1	1	682	
	Percent	0	6	5.4	16.3	33.8	30.2	11.5	1.8	.3	.1	.1	100.0%	

Table 27. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND PALM LENGTH  
FOR U. S. ARMY MEN (1966)

		PALM LENGTH								
		Centimeters								
		8.0	9.0	10.0	11.0	12.0	13.0	14.0	Totals	Percent
	27.0	:	:	:	2	1	3	:	6	
		:	:	:	:	:	:	:		
	26.0	:	:	1	7	15	3	:	26	
		:	:	:	:	:	:	:		
	25.0	:	:	.0	.1	.2	.0	:	.4	
		:	:	2	55	76	11	1	145	
		:	:	:	:	:	:	:		
	24.0	:	:	.0	.8	1.1	.2	.0	2.2	
		:	:	17	296	277	40	3	633	
		:	:	:	:	:	:	:		
H	23.0	:	:	.3	4.4	4.1	.6	.0	9.5	
A		:	:	130	935	580	43	:	1688	
N		:	:	:	:	:	:	:		
D		:	:	1.9	14.0	8.7	.6	:	25.3	
C	22.0	:	:	5	306	1432	492	24	2259	
e		:	:	:	:	:	:	:		
I		:	:	11	352	969	182	5	1519	
n		:	:	1.1	4.6	21.4	7.4	.4	33.8	
R		:	:	2	5.3	14.5	2.7	.1	22.7	
t		:	:	4	114	214	25	1	358	
C	21.0	:	:	1	1.7	3.2	.4	.0	5.4	
U		:	:	4	21	21	:	:	46	
m		:	:	1	3	3	:	:	.7	
M		:	:	1	1	:	:	:	2	
e		:	:	0	.0	:	:	:	.0	
R	20.0	:	:	1	1	:	:	:		
r		:	:	0	0	:	:	:		
E	19.0	:	:	1	1	:	:	:		
N		:	:	0	0	:	:	:		
C		:	:	1	1	:	:	:		
E		:	:	0	0	:	:	:		
Totals		25	944	3931	1648	130	4	6682		
Percent		.4	14.1	58.8	24.7	1.9	.1		100.0%	

Table 28. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND PALM LENGTH  
FOR U. S. ARMY WOMEN (1977)

		PALM LENGTH								
		Centimeters								
		8.0	9.0	10.0	11.0	12.0	13.0	14.0	Totals	Percent
		:	:	:	:	:	:	:	:	:
27.0		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
26.0		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
25.0		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
24.0		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
H A N D C I R C U M E R E S	23.0	:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	
	22.0	:	:	1:	3:	1:	:	:	5	
		:	:	:	:	:	:	:		
		:	:	.1:	.2:	.1:	:	:	.4	
	21.0	:	:	8:	37:	7:	:	:	52	
		:	:	:	:	:	:	:		
		:	:	.6:	2.8:	.5:	:	:	3.9	
	20.0	:	1:	106:	198:	19:	:	:	324	
		:	:	:	:	:	:	:		
		:	.1:	8.0:	14.9:	1.4:	:	:	24.4	
	19.0	:	7:	326:	228:	8:	:	:	569	
		:	:	:	:	:	:	:		
		:	.5:	24.5:	17.1:	.6:	:	:	42.8	
	18.0	:	23:	234:	72:	2:	:	:	331	
		:	:	:	:	:	:	:		
		:	1.7:	17.6:	5.4:	.2:	:	:	24.9	
	17.0	:	9:	31:	8:	:	:	:	48	
		:	:	:	:	:	:	:		
		:	.7:	2.3:	.6:	:	:	:	3.6	
	16.0	:	:	:	1:	:	:	:	1	
		:	:	:	:	:	:	:		
		:	:	.1:	:	:	:	:	.0	
15.0		:	:	:	:	:	:	:		
Totals		40	706	547	37	:	:	:	1330	
Percent		3.0	53.1	41.1	2.8				100.0%	

Table 29. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND PALM LENGTH  
FOR U. S. ARMY MEN AND WOMEN

		PALM LENGTH								
		Centimeters								
		8.0	9.0	10.0	11.0	12.0	13.0	14.0	Totals	Percent
	27.0	:	:	:	2	1	3	:	6	
		:	:	:	:	:	:	:		
		:	:	:	.0	.0	.0	:	.0	
	26.0	:	:	1	7	15	3	:	26	
		:	:	:	:	:	:	:		
		:	:	.0	.1	.2	.0	:	.3	
	25.0	:	:	2	55	76	11	1	145	
		:	:	:	:	:	:	:		
		:	:	.0	.7	.9	.1	.0	1.8	
	24.0	:	:	17	296	277	40	3	633	
		:	:	:	:	:	:	:		
		:	:	.2	3.7	3.5	.5	.0	7.9	
	23.0	:	:	130	935	580	43	:	1688	
		:	:	:	:	:	:	:		
		:	:	1.6	11.7	7.2	.5	:	21.1	
	22.0	:	5	307	1435	493	24	:	2264	
		:	:	:	:	:	:	:		
		:	.1	3.8	17.9	6.2	.3	:	28.3	
	21.0	:	11	360	1006	189	5	:	1571	
		:	:	:	:	:	:	:		
		:	.1	4.5	12.6	2.4	.1	:	19.6	
	20.0	:	5	220	412	44	1	:	682	
		:	:	:	:	:	:	:		
		:	.1	2.7	5.1	.5	.0	:	8.5	
	19.0	:	11	347	249	8	:	:	615	
		:	:	:	:	:	:	:		
		:	.1	4.3	3.1	.1	:	:	7.7	
	18.0	:	24	235	72	2	:	:	333	
		:	:	:	:	:	:	:		
		:	.3	2.9	.9	.0	:	:	4.2	
	17.0	:	9	31	8	:	:	:	48	
		:	:	:	:	:	:	:		
		:	.1	.4	.1	:	:	:	.6	
	16.0	:	:	:	1	:	:	:	1	
		:	:	:	:	:	:	:		
		:	:	:	.0	:	:	:	.0	
	15.0	:	:	:	:	:	:	:		
	Totals	65	1650	4478	1685	130	4	8012		
	Percent	.8	20.6	55.9	21.0	1.6	.1		100.0%	

Table 30. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND BREADTH  
FOR U. S. ARMY MEN (1966)

		HAND BREADTH							
		Centimeters							
		6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
		:	:	:	:	:	:	:	
27.0		:	:	:	:	1	5	6	
		:	:	:	:	:	:		
26.0		:	:	:	21	5	26		
		:	:	:	:	:	:		
25.0		:	:	4	101	40	145		
		:	:	:	:	:	:		
24.0		:	:	75	509	49	633		
		:	:	:	:	:	:		
23.0		:	:	384	1268	36	1688		
		:	:	:	:	:	:		
22.0		:	:	5.7	19.0	.5	25.3		
		:	:	9	1468	776	5	2258	
21.0		:	:	:	:	:			
		:	:	.1	22.0	11.6	.1	33.8	
20.0		:	:	32	1367	120	1519		
		:	:	:	:	:			
19.0		:	:	.5	20.5	1.8		22.7	
		:	:	71	278	9	358		
18.0		:	:	32	14		46		
		:	:	:	:	:			
17.0		:	:	.5	.2			.7	
		:	:	2				2	
16.0		:	:	0					
		:	:	:					
15.0		:	:	:					
		:	:	:					
Totals			146	3590	2805	140	6681		
Percent			2.2	53.7	42.0	2.1		100.0%	

Table 31. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND BREADTH  
FOR U. S. ARMY WOMEN (1977)

		HAND BREADTH							
		Centimeters							
		6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
		:	:	:	:	:	:	:	:
27.0		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
26.0		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
25.0		:	:	:	:	:	:		
		:	:	:	:	:	:		
24.0		:	:	:	:	:	:		
		:	:	:	:	:	:		
H		:	:	:	:	:	:		
A		:	:	:	:	:	:		
N		:	:	:	:	:	:		
D		:	:	:	:	:	:		
C		:	:	:	:	:	:		
I		:	:	:	2	3	:	5	
R		:	:	:	:	:	:		
C		:	:	:	2	2	:	.4	
U		:	:	:	2	2	:		
M		:	:	1	49	2	:	52	
F		:	:	:	:	:	:		
E		:	:	.1	3.7	.2	:	3.9	
R		20.0	:	:					
E		:	:	28	296	:	:	324	
N		:	:	:	:	:	:		
C		:	:	2.1	22.3	:	:	24.4	
E		19.0	:	:					
		:	:	432	137	:	:	569	
		:	:	:	:	:	:		
		:	:	32.5	10.3	:	:	42.8	
18.0		:	:	329	2	:	:	331	
		:	:	:	:	:	:		
		:	:	24.7	.2	:	:	24.9	
17.0		:	12	36	:	:	:	48	
		:	:	:	:	:	:		
		:	.9	2.7	:	:	:	3.6	
16.0		:	1	:	:	:	:	1	
		:	:	:	:	:	:		
15.0		:	.1	:	:	:	:	.0	
Totals		:	13	826	486	5	:	1330	
Percent			1.0	62.1	36.5	.4			100.0%

Table 32. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND BREADTH  
FOR U. S. ARMY MEN AND WOMEN

		HAND BREADTH							
		Centimeters							
		6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
		:	:	:	:	:	:	:	:
27.0		:	:	:	1	5	:	6	
		:	:	:	:	:	:		
		:	:	:	.0	.1	:		.1
26.0		:	:	:	21	5	:	26	
		:	:	:	:	:	:		
		:	:	:	.3	.1	:		.4
25.0		:	:	4	101	40	:	145	
		:	:	:	:	:	:		
		:	:	.0	1.3	.5	:		1.8
24.0		:	:	75	509	49	:	633	
		:	:	:	:	:	:		
H		:	:	.9	6.4	.6	:	7.9	
A		23.0	:	384	1268	36	:	1688	
N		:	:	:	:	:	:		
D		:	:	4.8	15.8	.4	:	21.0	
C		22.0	:	9	1470	779	5	2263	
e		:	:	:	:	:	:		
I		:	:	.1	18.3	9.7	.1	28.3	
R		21.0	:	33	1416	122	:	1571	
t		:	:	:	:	:	:		
C		:	:	.4	17.7	1.5	:	19.6	
U		20.0	:	99	574	9	:	682	
M		:	:	:	:	:	:		
F		:	:	1.2	7.2	.1	:	8.5	
E		19.0	:	464	151	:	:	615	
R		:	:	:	:	:	:		
E		:	:	5.8	1.9	:	:	7.7	
N		18.0	:	331	2	:	:	333	
C		:	:	:	:	:	:		
E		:	:	4.1	.0	:	:	4.2	
17.0		:	12	36	:	:	:	48	
		:	:	:	:	:	:		
16.0		:	.1	.4	:	:	:	.5	
		:	:	:	:	:	:		
15.0		:	.0	:	:	:	:	.0	
		:	:	:	:	:	:		
Totals		13	972	4076	2810	140	8011		
Percent		.2	12.1	50.9	35.1	1.7		100.0%	

Table 33. BIVARIATE TABLE OF HAND LENGTH AND PALM LENGTH  
FOR U. S. ARMY MEN (1966)

		PALM LENGTH								
		Centimeters								
		8.0	9.0	10.0	11.0	12.0	13.0	14.0	Totals	Percent
		:	:	:	:	:	:	:	:	:
24.0		:	:	:	:	:	2	3	5	
		:	:	:	:	:	:	:	:	
		:	:	:	:	:	.0	.0	.1	
23.0		:	:	:	:	5	19	1	25	
		:	:	:	:	:	:	:	:	
		:	:	:	:	.1	.3	.0	.4	
22.0		:	:	:	3	92	52	:	147	
		:	:	:	:	:	:	:	:	
		:	:	:	.0	1.4	.8	:	2.2	
21.0		:	:	:	179	686	50	:	915	
		:	:	:	:	:	:	:	:	
H C		:	:	:	2.7	10.3	.7	:	13.7	
A		20.0	:	28	1547	756	7	:	2338	
N			:	:	:	:	:	:		
D			:	:	:	:	:	:		
L			:	.4	23.2	11.3	.1	:	35.0	
E			:	1	389	1923	107	:	2420	
H			:	:	:	:	:	:		
G			:	.0	5.8	28.8	1.6	:	36.2	
T			:	10	466	277	2	:	755	
H			:	:	:	:	:	:		
s			:	.1	7.0	4.1	.0	:	11.3	
17.0		:	12	60	2	:	:	:	74	
		:	:	:	:	:	:	:		
		:	.2	.9	.0	:	:	:	1.1	
16.0		:	2	1	:	:	:	:	3	
		:	:	:	:	:	:	:		
		:	.0	.0	:	:	:	:	.0	
15.0		:	:	:	:	:	:	:		
		:	:	:	:	:	:	:		
		:	:	:	:	:	:	:		
14.0		:	:	:	:	:	:	:		
		:	:	:	:	:	:	:		
Totals		25	944	3931	1648	130	4	6682		
Percent		.2	14.1	58.8	24.7	1.9	.1		100.0%	

Table 34. BIVARIATE TABLE OF HAND LENGTH AND PALM LENGTH FOR U. S. ARMY WOMEN (1977)

PALM LENGTH								
Centimeters								
	8.0	9.0	10.0	11.0	12.0	13.0	14.0	Totals Percent
24.0	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
23.0	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
22.0	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
21.0	:	:	:	:	5	:	:	5
	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	
H C	:	:	:	:	.4	:	:	.4
A e	20.0	:	:	:				
N n	:	:	:	54	25	:	:	79
D t	:	:	:	:	:	:	:	
L i	:	:	:	4.1	1.9	:	:	5.9
E m	19.0	:	17	262	7	:	:	286
N e	:	:	:	:	:	:	:	
G r	:	:	1.3	19.7	.5	:	:	21.5
T s	18.0	:	325	227	:	:	:	552
	:	:	:	:	:	:	:	
	:	:	24.4	17.1	:	:	:	41.5
17.0	:	14	341	4	:	:	:	359
	:	:	:	:	:	:	:	
	:	1.1	25.6	.3	:	:	:	27.0
16.0	:	25	23	:	:	:	:	48
	:	:	:	:	:	:	:	
	:	1.9	1.7	:	:	:	:	3.6
15.0	:	1	:	:	:	:	:	1
	:	:	:	:	:	:	:	
	:	.1	:	:	:	:	:	.1
14.0	:							
Totals	:	40	706	547	37	:	:	1330
Percent	3.0	53.1	41.1	2.8				100.0%

Table 35. BIVARIATE TABLE OF HAND LENGTH AND PALM LENGTH  
FOR U. S. ARMY MEN AND WOMEN

		PALM LENGTH								
		Centimeters								
		8.0	9.0	10.0	11.0	12.0	13.0	14.0	Totals	Percent
		:	:	:	:	:	:	:	:	:
24.0		:	:	:	:	:	2	3	5	
		:	:	:	:	:	:	:	:	
		:	:	:	:	:	.0	.0	.1	
23.0		:	:	:	:	5	19	1	25	
		:	:	:	:	:	:	:	:	
		:	:	:	:	.1	.2	.0	.3	
22.0		:	:	:	3	92	52	:	147	
		:	:	:	:	:	:	:	:	
		:	:	:	.0	1.1	.6	:	1.8	
21.0		:	:	:	179	691	50	:	920	
		:	:	:	:	:	:	:	:	
H C		:	:	:	2.2	8.6	.6	:	11.5	
A e		20.0								
N n		:	:	28	1601	781	7	:	2417	
D t		:	:	:	:	:	:	:	:	
L i		:	:	.3	20.0	9.7	.1	:	30.2	
E m		19.0								
N e		:	1	406	2185	114	:	:	2706	
G t		:	:	:	:	:	:	:	:	
T G		:	.0	5.1	27.3	1.4	:	:	33.8	
H r		18.0								
H s		:	10	791	504	2	:	:	1307	
		:	:	:	:	:	:	:	:	
		:	.1	9.9	6.3	.0	:	:	16.3	
17.0										
		:	26	401	6	:	:	:	433	
		:	:	:	:	:	:	:	:	
		:	.3	5.0	.1	:	:	:	5.4	
16.0										
		:	27	24	:	:	:	:	51	
		:	:	:	:	:	:	:	:	
		:	.3	.3	:	:	:	:	.6	
15.0										
		:	1	:	:	:	:	:	1	
		:	:	:	:	:	:	:	:	
		:	.0	:	:	:	:	:	.0	
14.0										
		:	:	:	:	:	:	:		
Totals		65	1650	4478	1685	130	4	8012		
Percent		.8	20.6	55.9	21.0	1.6	.1		100.0%	

Table 36. BIVARIATE TABLE OF HAND LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN (1966)

		HAND BREADTH							
		Centimeters							
		6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
		:	:	:	:	:	:	:	:
H		24.0							
		:	:	:	:	4	:	1	:
		:	:	:	:	:	:	:	
		:	:	:	:	.1	:	.0	
C		23.0							
		:	:	:	:	18	:	7	:
		:	:	:	:	:	:	:	
		:	:	:	:	.3	:	.1	
A		22.0							
		:	:	:	12	:	113	:	147
		:	:	:	:	:	:	:	
		:	:	:	.2	:	1.7	:	.3
N		21.0							
		:	:	1	:	231	:	634	:
		:	:	:	:	:	:	:	
		:	:	.0	:	3.5	:	9.5	:
D		20.0							
		:	:	:	8	:	1067	:	1211
		:	:	:	:	:	:	52	:
		:	:	:	:	:	:	:	
L		19.0							
		:	:	:	.1	:	16.0	:	18.1
		:	:	:	:	:	:	:	
E		18.0							
		:	:	55	:	1626	:	730	:
		:	:	:	:	:	:	8	:
N		17.0							
		:	:	:	:	:	:	:	
G		16.0							
		:	:	.8	:	24.3	:	10.9	:
T		15.0							
		:	:	:	3	:	:	:	
H		14.0							
		:	:	:	:	:	:	:	
C		Totals			146	:	3590	:	2805
						:		:	140
						:		:	6681
A		Percent			2.2	53.7	42.0	2.1	100.0%

Table 37. BIVARIATE TABLE OF HAND LENGTH AND HAND BREADTH  
FOR U. S. ARMY WOMEN (1977)

		HAND BREADTH							
		Centimeters							
		6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
		:	:	:	:	:	:	:	:
H		24.0							
A		:	:	:	:	:	:		
C		:	:	:	:	:	:		
e		:	:	:	:	:	:		
N		23.0							
D		:	:	:	:	:	:		
n		:	:	:	:	:	:		
t		:	:	:	:	:	:		
i		22.0							
L		:	:	:	:	:	:		
m		:	:	:	:	:	:		
E		21.0							
N		:	:	1	:	3	:	5	
t		:	:	:	:	:	:		
G		20.0		:	:	1	:		
e		:	:	1.1	:	.2	:		
T		19.0		:	:	.1	:		
r		:	:	17	:	61	:	79	
H		18.0		:	:	1	:		
s		:	:	:	:	:	:		
17.0		17.0		2	:	370	:	552	
		:	:	:	:	:	:		
		16.0		1.2	:	27.8	:	41.5	
		:	:	95	:	189	:	286	
		15.0		1.3	:	4.6	:	5.9	
		:	:	7.1	:	14.2	:	21.5	
		14.0		1.5	:	22.7	:	27.0	
		:	:	7	:	50	:	359	
		13.0		1.3	:	3.8	:		
		:	:	40	:	4	:	48	
		12.0		1.3	:	3.0	:	3.6	
		:	:	1	:	3.0	:	1	
		11.0		1.1	:	1.1	:		
		10.0		1.1	:	1.1	:		
		9.0		1.1	:	1.1	:		
		8.0		1.1	:	1.1	:		
		7.0		1.0	:	1.0	:		
		6.0		1.0	:	1.0	:		
		Totals		13	826	486	5	1330	
		Percent		1.0	62.1	36.5	.4	100.0%	

Table 38. BIVARIATE TABLE OF HAND LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN AND WOMEN

HAND BREADTH								
Centimeters								
	6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
24.0	:	:	:	:	4	1	5	
	:	:	:	:	:	:		
	:	:	:	:	0	0	.1	
23.0	:	:	:	18	7	25		
	:	:	:	:	:	:		
	:	:	:	2	.2	.1	.3	
22.0	:	:	12	113	22	147		
	:	:	:	:	:	:		
	:	1.1	1.4	.3			1.8	
21.0	:	2	234	635	49	920		
	:	:	:	:	:	:		
H C	:	.0	2.9	7.9	.6	11.5		
A e	20.0							
N	:	25	1128	1212	52	2417		
D	:	:	:	:	:	:		
i	:	.3	14.1	15.1	.6	30.2		
L m	19.0							
E	:	150	1815	732	8	2705		
N	:	:	:	:	:	:		
G	:	1.9	22.7	9.1	.1	33.8		
T	18.0							
H	:	?	430	781	93	1307		
s	:	:	:	:	:	:		
	:	.0	5.4	9.7	1.2	.0	16.3	
17.0	:	7	321	102	3	433		
	:	:	:	:	:	:		
	:	.1	4.0	1.3	.0		5.4	
16.0	:	4	43	4		51		
	:	:	:	:	:			
	:	.0	.5	.0	:		.6	
15.0	:	1				1		
	:	:	:	:	:			
	:	.0					.0	
14.0	:	:	:	:	:			
Totals	13	972	4076	2810	140	8011		
Percent	.2	12.1	50.9	35.1	1.7	100.0%		

Table 39. BIVARIATE TABLE OF PALM LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN (1966)

HAND BREADTH									
Centimeters									
		6.0	7.0	8.0	9.0	10.0	11.0	Totals	Percent
		:	:	:	:	:	:	:	:
		14.0							
		:	:	:	:	4	:	4	
		:	:	:	:	:	:	:	
		:	:	:	:	.1	:		.1
		13.0							
		:	:	:	21	:	92	:	130
		:	:	:	:	:	:		
P	C	:	:	:	.3	:	1.4	:	.3
A	e	12.0							1.9
L	n	:	:	6	:	556	:	1026	:
M	t	:	:	:	:	:	:		
i		:	:	.1	:	8.3	:	15.4	:
L	m	11.0							24.7
E	e	:	:	67	:	2338	:	1468	:
N	t	:	:	:	:	:	:		
G	e	:	:	1.0	:	35.0	:	22.0	:
T	r	10.0							58.8
H	s	:	:	68	:	655	:	215	:
		:	:	:	:	:	:		
		:	:	1.0	:	9.8	:	3.2	:
		9.0							14.1
		:	:	5	:	20	:	:	25
		:	:	:	:	:	:		
		:	:	.1	:	.3	:	:	.4
		8.0							
		:	:	:	:	:	:	:	
		Totals		146	3590	2805	140	6681	
		Percent		2.2	53.7	42.0	2.1		100.0%

Table 40. BIVARIATE TABLE OF PALM LENGTH AND HAND BREADTH  
FOR U. S. ARMY WOMEN (1977)

		HAND BREADTH						Percent
		Centimeters						
		6.0	7.0	8.0	9.0	10.0	11.0	Totals
		:	:	:	:	:	:	:
P	C	14.0						
		:	:	:	:	:	:	
		:	:	:	:	:	:	
		:	:	:	:	:	:	
A	C	13.0						
		:	:	:	:	:	:	
		:	:	:	:	:	:	
		:	:	:	:	:	:	
L	n	12.0						
M	t	:	:	9	27	1	:	37
i	m	:	:	:	:	:	:	
L	m	11.0						
E	m	:	2	253	288	4	:	547
N	t	:	:	:	:	:	:	
G	e	:	.2	19.0	21.7	.3	:	41.1
T	r	10.0						
H	s	:	8	531	167	:	:	706
		:	:	:	:	:	:	
		:	.6	39.9	12.6	:	:	53.1
		9.0						
		:	3	33	4	:	:	40
		:	:	:	:	:	:	
		:	.2	2.5	.3	:	:	3.0
		8.0						
		:						
		Totals	13	826	486	5	:	1330
		Percent	1.0	62.1	36.5	.4		100.0%

Table 41. BIVARIATE TABLE OF PALM LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN AND WOMEN

HAND BREADTH							Percent
Centimeters							
	6.0	7.0	8.0	9.0	10.0	11.0	Totals
14.0	:	:	:	:	4	:	4
	:	:	:	:	:	:	
	:	:	:	:	.0	:	.0
13.0	:	:	:	21	92	17	130
	:	:	:	:	:	:	
P C	:	:	:	.3	1.1	.2	1.6
A	12.0						
L		:	15	583	1027	60	1685
M		:	:	:	:	:	
i		:	.2	7.3	12.8	.7	21.0
L	11.0						
E		:	2	320	2626	1472	4477
N		:	:	:	:	:	
G		:	.0	4.0	32.8	18.4	55.9
T	10.0						
H		:	8	599	822	215	1650
		:	:	:	:	:	
		:	.1	7.5	10.3	2.7	20.7
9.0							
	:	3	38	24	:	:	65
	:	:	:	:	:	:	
	:	.0	.5	.3	:	:	.8
8.0							
	:	:	:	:	:	:	
Totals	13	972	4076	2810	140	8011	
Percent	.2	12.1	50.9	35.1	1.7		100.0%

Table 42. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH  
FOR U. S. ARMY MEN (1966)

HAND LENGTH										Percent
Inches										
	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	Totals
	:	:	:	:	:	:	:	:	:	
	10.5									
	:	:	:	:	1	:	7	:	5	
	:	:	:	:	:	:	:	:	:	15
	:	:	:	:	0	:	1	:	0	
	10.0									
	:	:	:	:	16	:	42	:	28	
	:	:	:	:	:	:	:	:	:	96
	:	:	:	:	2	:	6	:	2	
	9.5				2	:	6	:	0	
H	:	:	:	6	:	175	:	404	:	28
A	:	:	:	:	:	:	:	:	:	
N	:	:	:	1	:	2.6	:	6.0	:	4
D	9.0			2	:	6.0	:	2.5	:	782
C	:	:	:	2	:	2.5	:	4.0	:	
I	8.5			3	:	1.1	:	13.6	:	11.7
R	:	:	:	3	:	13.6	:	18.0	:	
n	:	:	:	4	:	18.0	:	3.8	:	36.7
C	8.0			4	:	1.1	:	1.1	:	2452
U	:	:	5	:	1	:	1	:	1	
M	:	:	5	:	1	:	1	:	1	
F	7.5			6	:	1202	:	254	:	2443
E	:	:	6	:	6	:	9	:	1	
R	:	:	6	:	6	:	1	:	1	
E	7.0			7	:	77	:	2	:	
N	:	:	7	:	7	:	2	:	2	
C	6.5			8	:	254	:	9	:	835
E	:	:	8	:	8	:	1	:	1	
	6.0			8	:	1202	:	1	:	
	:	:	8	:	8	:	1	:	1	
	Totals	29	521	2938	2602	536	49	7	1	6682
	Percent	.4	7.8	44.0	39.0	8.0	.7	.1		100.0%

Table 43. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH  
FOR U. S. ARMY WOMEN (1977)

		HAND LENGTH										
		Inches										
		5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	Totals	Percent
H A N D C I R n I n c u m F s	10.5	:	:	:	:	:	:	:	:	:		
	10.0	:	:	:	:	:	:	:	:	:		
	9.5	:	:	:	:	:	:	:	:	:		
	9.0	:	:	:	:	:	:	:	:	:		
	8.5	:	:	:	1	6	7	:	:	:	14	
	C U M F s	:	:	:	:	:	:	:	:	:		1.1
	8.0	:	:	4	95	156	44	1	:	:	300	
	E R E N C E	:	:	:	:	:	:	:	:	:	22.5	
	7.5	:	:	.3	7.1	11.7	3.3	.1	:	:	734	
	7.0	:	:	91	412	217	14	:	:	:	55.2	
C I R n I n c u m F s	6.5	:	4	105	142	18	1	:	:	:	270	
	6.0	:	:	:	:	:	:	:	:	:	20.3	
	Totals	5	207	654	397	66	1	:	:	:	1330	
	Percent	.4	15.5	49.2	29.8	5.0	.1				100.0%	

Table 44. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH  
FOR U. S. ARMY MEN AND WOMEN

HAND LENGTH										
Inches										
	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	Totals Percent
10.5	:	:	:	:	:	:	:	:	:	
	:	:	:	:	1	7	5	2	:	15
	:	:	:	:	:	:	:	:	:	
10.0	:	:	:	:	.0	.1	.1	.0	:	.2
	:	:	:	:	16	42	28	8	2	96
	:	:	:	:	:	:	:	:	:	
9.5	:	:	:	:	.2	.5	.3	.1	.0	1.1
H	:	:	:	6	175	404	165	28	4	
A	:	:	:	:	:	:	:	:	:	
N	:	:	:	.1	2.2	5.0	2.1	.3	.0	9.8
D	9.0	:	:	75	911	1202	254	9	1	2452
C	:	:	:	:	:	:	:	:	:	
I	8.5	:	:	.9	11.4	15.0	3.2	.1	.0	30.6
R	:	:	:	:	:	:	:	:	:	
U	8.0	:	:	10	239	1331	798	77	2	2457
M	:	:	:	:	:	:	:	:	:	
F	7.5	:	:	.1	3.0	16.6	10.0	1.0	.0	30.7
E	:	:	:	15	275	640	197	8	:	
R	7.0	:	:	:	:	:	:	:	:	1135
E	:	:	:	:	:	:	:	:	:	
N	6.5	:	:	.2	3.4	8.0	2.5	.1	:	14.2
C	:	:	99	434	243	17	:	:	:	
E	6.0	:	:	1.2	5.4	3.0	.2	:	:	793
Totals	:	5	236	1175	3335	2668	537	49	7	8012
Percent	.1	2.9	14.7	41.6	33.3	6.7	.6	.1		100.0%

Table 45. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND PALM LENGTH  
FOR U. S. ARMY MEN (1966)

		PALM LENGTH							
		Inches							
		3.0	3.5	4.0	4.5	5.0	5.5	Totals	Percent
H A N D C I R C U M F E R E N C E	10.5	:	:	:	:	:	:	:	
		:	:	1	:	8	:	6	:
		:	:	:	:	:	:	:	15
		:	:	.0	:	.1	:	.1	:
	10.0								.2
		:	:	2	:	60	:	32	:
		:	:	:	:	:	:	:	96
		:	:	.0	:	.9	:	.5	:
	9.5								1.4
		:	:	48	:	553	:	174	:
		:	:	:	:	:	:	7	:
		:	:	.7	:	8.3	:	2.6	:
	9.0								11.7
		:	:	371	:	1827	:	252	:
		:	:	:	:	:	:	2	:
		:	:	5.6	:	27.3	:	3.8	:
	8.5								36.7
		:	6	:	695	:	1649	:	92
		:	:	:	:	:	:	1	:
		:	:	.1	:	10.4	:	24.7	:
	8.0								36.6
		:	7	:	351	:	464	:	13
		:	:	:	:	:	:	:	:
		:	.1	:	5.3	:	6.9	:	.2
	7.5								12.5
		:	3	:	33	:	23	:	:
		:	:	:	:	:	:	:	:
		:	.0	:	.5	:	.3	:	:
	7.0								.9
		:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:
	6.5								
		:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:
	6.0								
		:	:	:	:	:	:	:	:
	Totals	16	1501	4584	569	12	:	6682	
	Percent	.2	22.5	68.6	8.5	.2		100.0%	

Table 46. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND PALM LENGTH  
FOR U. S. ARMY WOMEN (1977)

		PALM LENGTH							
		Inches							
		3.0	3.5	4.0	4.5	5.0	5.5	Totals	Percent
		:	:	:	:	:	:	:	:
H A N D C I R C U M F E R E C E	10.5								
		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
	10.0								
		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
	9.5								
		:	:	:	:	:	:		
C I R C U M F E R E C E	9.0								
		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
	8.5								
		:	:	4	:	10	:		14
		:	:	:	:	:	:		
		:	:	:	:	:	:		
	8.0								
		:	1	:	134	:	163	:	300
C I R C U M F E R E C E	7.5								
		:	:	:	:	:	:		
		:	1	:	10.1	:	12.3	:	22.5
		:	:	:	:	:	:		
	7.0								
		:	8	:	548	:	177	:	734
		:	:	:	:	:	:		
		:	6	:	41.2	:	13.3	:	55.2
	6.5								
		:	15	:	231	:	24	:	270
C I R C U M F E R E C E	6.0								
		:	:	:	:	:	:		
		:	1.1	:	17.4	:	1.8	:	20.3
Totals		25	928	374	:	3	:	1330	
Percent		1.9	69.6	28.2	.	3	.	100.0%	

Table 47. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND PALM LENGTH  
FOR U. S. ARMY MEN AND WOMEN

PALM LENGTH							Percent
Inches						Totals	
	3.0	3.5	4.0	4.5	5.0	5.5	
10.5	:	:	1	8	6	:	15
	:	:	:	:	:	:	
	:	:	.0	.1	.1	:	.2
10.0	:	:	2	60	32	2	96
	:	:	:	:	:	:	
	:	:	.0	.7	.4	.0	1.1
9.5	:	:	48	553	174	7	782
	:	:	:	:	:	:	
	:	:	.6	6.9	2.2	.1	9.8
9.0	:	:	371	1827	252	2	2452
	:	:	:	:	:	:	
	:	:	4.6	22.8	3.1	.0	30.6
8.5	:	:	6	699	1659	92	2457
	:	:	:	:	:	:	
	:	:	.1	8.7	20.7	1.1	30.7
8.0	:	:	8	485	627	15	1135
	:	:	:	:	:	:	
	:	:	.1	6.1	7.8	.2	14.2
7.5	:	:	11	581	200	1	793
	:	:	:	:	:	:	
	:	:	.1	7.3	2.5	.0	9.9
7.0	:	:	15	231	24	:	270
	:	:	:	:	:	:	
	:	:	.2	2.9	.3	:	3.4
6.5	:	:	1	11	:	:	12
	:	:	:	:	:	:	
	:	:	.0	.1	:	:	.1
6.0	:	:	:	:	:	:	
	:	:					
Totals	41	2429	4958	572	12	8012	
Percent	.5	30.4	61.9	7.1	.1	100.0%	

Table 48. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND BREADTH  
FOR U. S. ARMY MEN (1966)

HAND BREADTH							
Inches							
	2.5	3.0	3.5	4.0	4.5	Totals	Percent
	:	:	:	:	:	:	
10.5	:	:	:	11	:	4	15
	:	:	:	:	:	:	
	:	:	:	.2	:	.1	.2
10.0	:	:	1	78	:	17	96
	:	:	:	:	:	:	
	:	:	.0	1.2	:	.3	1.4
9.5	:	:	46	704	:	32	782
	:	:	:	:	:	:	
	:	:	.7	10.5	:	.5	11.7
9.0	:	:	547	1893	:	12	2452
	:	:	:	:	:	:	
	:	:	8.2	28.3	:	.2	36.7
8.5	:	:	5	1725	:	712	2442
	:	:	:	:	:	:	
	:	:	.1	25.8	:	10.7	36.6
8.0	:	:	.1	11.7	:	.7	12.5
	:	:	6	781	:	48	835
	:	:	:	:	:	:	
	:	:	.1	11.7	:	.7	
7.5	:	15	:	44	:	:	59
	:	:	:	:	:	:	
	:	:	.2	.7	:	:	.9
7.0	:	:	:	:	:	:	
	:	:	:	:	:	:	
	:	:	:	:	:	:	
6.5	:	:	:	:	:	:	
	:	:	:	:	:	:	
	:	:	:	:	:	:	
6.0	:	26	:	3144	:	3446	65
							6681
Totals							
Percent		.4	47.0	51.5	1.1		100.0%

Table 49. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND BREADTH  
FOR U. S. ARMY WOMEN (1977)

		HAND BREADTH					Percent
		2.5	3.0	3.5	4.0	4.5	
		:	:	:	:	:	
		10.5	—	—	—	—	
		:	:	:	:	:	
		10.0	—	—	—	—	
		:	:	:	:	:	
		9.5	—	—	—	—	
		:	:	:	:	:	
H	A	9.0	—	—	—	—	
A	N	:	:	:	:	:	
N	D	8.5	—	—	—	—	
		:	:	8	6	:	14
C	I	8.0	—	—	—	—	
I	R	:	:	:	:	:	
R	M	7.5	—	—	—	—	
M	F	:	300	:	:	:	300
F	E	7.0	—	—	—	—	
E	R	:	:	:	:	:	22.6
R	E	6.5	—	—	—	—	
E	N	:	180	554	:	:	734
N	C	6.0	—	—	—	—	
C	E	:	13.5	41.7	:	:	55.1
		:	253	17	:	:	270
		:	19.0	1.3	:	:	20.3
		:	12	:	:	:	12
		:	.9	:	:	:	.9
		Totals	445	879	6	:	1330
		Percent	33.5	66.0	.5		100.0%

Table 50. BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND BREADTH  
FOR U. S. ARMY MEN AND WOMEN

HAND BREADTH							
Inches							
	2.5	3.0	3.5	4.0	4.5	Totals	Percent
	:	:	:	:	:		
10.5							
	:	:	:	11	4	15	
	:	:	:	:	:		
	:	:	:	.1	.0	.2	
10.0							
	:	:	1	79	17	96	
	:	:	:	:	:		
	:	:	.0	1.0	.2	1.1	
9.5							
H	:	:	46	704	32	782	
A	:	:	:	:	:		
N	:	:	.6	8.8	.4	9.8	
D	9.0						
	:	:	547	1893	12	2452	
C	:	:	:	:	:		
I	:	:	6.8	23.6	.1	30.6	
R	8.5						
n	:	5	1733	718	:	2456	
C	:	:	:	:	:		
U	:	:	:	:	:		
M	:	.1	21.6	9.0	:	30.7	
F	8.0						
E	:	6	1081	48	:	1135	
R	:	:	:	:	:		
E	:	.1	13.5	.6	:	14.2	
N	7.5						
C	:	195	599	:	:	793	
E	:	:	:	:	:		
	:	2.4	7.5	:	:	9.9	
7.0							
	:	253	17	:	:	270	
	:	:	:	:	:		
	:	3.2	.2	:	:	3.4	
6.5							
	:	12	:	:	:	12	
	:	:	:	:	:		
	:	.1	:	:	:	.1	
6.0							
	:	:	:	:	:		
Totals	471	4023	3452	65	8011		
Percent	5.9	50.2	43.1	.8	100.0%		

Table 51. BIVARIATE TABLE OF HAND LENGTH AND PALM LENGTH  
FOR U. S. ARMY MEN (1966)

PALM LENGTH								
Inches								
	3.0	3.5	4.0	4.5	5.0	5.5	Totals	Percent
	:	:	:	:	:	:	:	:
9.5								
	:	:	:	:	3	4	7	
	:	:	:	:	:	:		
	:	:	:	:	.0	.1		.1
9.0								
	:	:	:	3	40	6	49	
	:	:	:	:	:	:		
	:	:	:	.0	.6	.1		.7
8.5								
	:	:	:	235	299	2	536	
	:	:	:	:	:	:		
	:	:	:	3.5	4.5	.0		8.0
H								
A								
N	I							
D	n	:	69	2313	220	:	2602	
c	:	:	:	:	:	:		
L	h	:	1.0	34.6	3.3	:		38.9
E	e	:	958	1973	7	:	2938	
N	s	:	:	:	:	:		
G	:	:	14.3	29.5	.1	:		44.0
T								
H								
	7.5							
	:	11	450	60	:	:	521	
	:	:	:	:	:	:		
	:	.2	6.7	.9	:	:		7.8
	6.5							
	:	5	24	:	:	:	29	
	:	:	:	:	:	:		
	:	.1	.4	:	:	:		.5
	6.0							
	:	:	:	:	:	:		
	:	:	:	:	:	:		
	:	:	:	:	:	:		
	5.5							
	:	:	:	:	:	:		
Totals		16	1501	4584	569	12	6682	
Percent		.2	22.5	68.6	8.5	.2		100.0%

Table 52. BIVARIATE TABLE OF HAND LENGTH AND PALM LENGTH  
FOR U. S. ARMY WOMEN (1977)

		PALM LENGTH							
		Inches							
		3.0	3.5	4.0	4.5	5.0	5.5	Totals	Percent
		:	:	:	:	:	:	:	:
9.5		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
9.0									
		:	:	:	:	:	:		
		:	:	:	:	:	:		
		:	:	:	:	:	:		
8.5									
		:	:	:	:	1	:		1
		:	:	:	:	:	:		
H A N D L E N G T H	8.0	:	:	:	:	.1	:		.1
	I	:	:	:	64	2	:		66
	n	:	:	:	:	:			
	c	:	:	:	4.8	.2	:		5.0
	h	7.5							
E		:	:	133	264	:			397
N		:	:	:	:				
G		:	:	10.0	19.8	:			29.8
T		7.0							
H		:	:	608	46	:			654
		:	:	:	:				
		:	:	45.7	3.5	:			49.1
6.5									
		:	21	186	:	:			207
		:	:	:	:				
		:	1.6	14.0	:	:			15.6
6.0									
		:	4	1	:	:			5
		:	:	:	:				
		:	.3	.1	:	:			.4
5.5									
		:	:	:	:				
Totals		25	928	374	:	3	:	1330	
Percent		1.9	69.8	28.1	.2				100.0%

Table 53. BIVARIATE TABLE OF HAND LENGTH AND PALM LENGTH  
FOR U. S. ARMY MEN AND WOMEN

PALM LENGTH								
Inches								
	3.0	3.5	4.0	4.5	5.0	5.5	Totals	Percent
9.5	:	:	:	:	3	4	7	
	:	:	:	:	:	:		
	:	:	:	:	.0	.0		.1
9.0	:	:	:	3	40	6	49	
	:	:	:	:	:	:		
	:	:	:	.0	.5	.1		.6
8.5	:	:	:	235	300	2	537	
	:	:	:	:	:	:		
	:	:	:	2.9	3.7	.0		6.7
8.0	:	:	69	2377	222	:	2668	
	:	:	:	:	:	:		
	:	:	.9	29.7	2.8	:		33.3
7.5	:	:	1091	2237	7	:	3335	
	:	:	:	:	:	:		
	:	:	13.6	27.9	.1	:		41.6
7.0	:	11	1058	106	:	:	1175	
	:	:	:	:	:	:		
	:	.1	13.2	1.3	:	:		14.7
6.5	:	26	210	:	:	:	236	
	:	:	:	:	:	:		
	:	.3	2.6	:	:	:		2.9
6.0	:	4	.1	:	:	:	5	
	:	:	:	:	:	:		
	:	.0	.0	:	:	:		.1
5.5	:	:	:	:	:	:		
Totals	41	2429	4958	572	12	:	8012	
Percent	.5	30.3	61.9	7.1	.1			100.0%

Table 54. BIVARIATE TABLE OF HAND LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN (1966)

		HAND BREADTH					Totals	Percent
		2.5	3.0	3.5	4.0	4.5		
H A N D I n c L h E N G T H	9.5	:	:	:	7	:	7	
	9.0	:	:	:	:	:		.1
	8.5	:	:	.1	.1	:		.7
	8.0	:	:	65	448	23	536	
	7.5	:	:	:	:	:		
	7.0	:	2	855	1715	30	2602	
	6.5	:	:	:	:	:		
	6.0	:	9	1765	1160	3	2937	
	5.5	:	:	:	:	:		
	Totals	26	3114	3446	65	6681		
Percent		.3	47.1	51.6	1.0		100.0%	

Table 55. BIVARIATE TABLE OF HAND LENGTH AND HAND BREADTH FOR U. S. ARMY WOMEN (1977)

HAND BREADTH						
Inches						
	2.5	3.0	3.5	4.0	4.5	Totals Percent
	:	:	:	:	:	
9.5	—					
	:	:	:	:	:	
	:	:	:	:	:	
	:	:	:	:	:	
9.0	—					
	:	:	:	:	:	
	:	:	:	:	:	
	:	:	:	:	:	
8.5	—					
	:	:	1:	:	:	1
	:	:	:	:	:	
	:	:	.1:	:	:	.1
8.0	—					
H	I	:	1:	63:	2:	66
A	n	:	:	:	:	
N	c	:	.1:	4.7:	.2:	5.0
D	h	7.5	—			
L	e	:	39:	354:	4:	397
E	n	:	:	:	:	
N	g	:	2.9:	26.6:	.3:	29.8
G	t	7.0	—			
T	h	:	251:	403:	:	654
		:	:	:	:	
		:	18.9:	30.3:	:	49.1
6.5	—					
	:	149:	58:	:	:	207
	:	:	:	:	:	
	:	11.2:	4.4:	:	:	15.6
6.0	—					
	:	5:	:	:	:	5
	:	:	:	:	:	
	:	.4:	:	:	:	.4
5.5	—					
	:	:	:	:	:	
Totals		445	879	6		1330
Percent		33.5	66.0	.5		100.0%

Table 56. BIVARIATE TABLE OF HAND LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN AND WOMEN

HAND BREADTH							
Inches							
	2.5	3.0	3.5	4.0	4.5	Totals	Percent
9.5	:	:	:	7	:	7	
	:	:	:	:	:		
	:	:	:	.1	:		.1
9.0	:	:	1	39	9	49	
	:	:	:	:	:		
	:	:	.0	.5	.1		.6
8.5	:	:	66	448	23	537	
	:	:	:	:	:		
	:	:	.9	5.6	.3		.67
8.0							
N	I	:	3	918	1717	30	2668
D	I	:	:	:	:		
I	n	:	:	:	:		
c	c	:	.0	11.5	21.4	.4	33.3
L	h	7.5					
E	h	:	48	2119	1164	3	3334
N	e	:	:	:	:		
N	s	:	:	:	:		
G	g	:	.6	26.5	14.5	.0	41.6
T	7.0						
H	H	:	260	838	77	:	1175
		:	:	:	:		
		:	3.8	10.5	1.0	:	14.7
6.5							
		:	155	81	:	:	236
		:	:	:	:		
		:	1.9	1.0	:	:	2.9
6.0							
		:	5	:	:	:	5
		:	:	:	:		
		:	.1	:	:	:	.1
5.5							
		:	:	:	:	:	
Totals		471	4023	3452	65	8011	
Percent		5.9	50.2	43.1	.8		100.0%

Table 57. BIVARIATE TABLE OF PALM LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN (1966)

HAND BREADTH								
Inches								
		2.5	3.0	3.5	4.0	4.5	Totals	Percent
		:	:	:	:	:	:	:
		5.5						
		:	:	:	11	1	12	
		:	:	:	:	:		
		:	:	:	.2	.0		.2
		5.0						
		:	:	92	455	22	569	
		:	:	:	:	:		
		:	:	1.4	6.8	.3		8.5
P	A	I	4.5					
M	n		:	6	2045	2493	39	4583
L	c		:	:	:	:		
E	h		:	.1	30.6	37.3	.6	68.6
N	e	I	4.0					
G	s		:	18	993	487	3	1501
T			:	:	:	:		
H			:	.3	14.9	7.3	.0	22.5
			3.5					
			:	2	14	:		16
			:	:	:	:		
			:	.0	.2	:		.2
			3.0					
			:	:	:	:		
			Totals	26	3144	3446	65	6681
			Percent	.3	47.1	51.6	1.0	100.0%

Table 58. BIVARIATE TABLE OF PALM LENGTH AND HAND BREADTH  
FOR U. S. ARMY WOMEN (1977)

HAND BREADTH						
Inches						
	2.5	3.0	3.5	4.0	4.5	Totals Percent
	:	:	:	:	:	
5.5	5.5					
	:	:	:	:	:	
	:	:	:	:	:	
	:	:	:	:	:	
	5.0	5.0				
	:	:	3	:	:	3
	:	:	:	:	:	
P	A	L	I	4.5		.3
M	n	c		4.5		
L	h			4.0		
E	e			4.0		
N	s			3.5		
G				3.5		
T				3.5		
H				3.5		
				3.0		
				3.0		
				Totals	1330	
				Percent	33.5 66.0 .5	100.0%

Table 59. BIVARIATE TABLE OF PAIM LENGTH AND HAND BREADTH  
FOR U. S. ARMY MEN AND WOMEN

HAND BREADTH						
Inches						
	2.5	3.0	3.5	4.0	4.5	Totals Percent
	:	:	:	11	:	12
	:	:	:	:	:	
	:	:	:	.1	:	.1
	5.5					
	:	:	95	455	:	572
	:	:	:	:	:	
	:	:	1.2	5.7	:	7.1
P	5.0					
	:	:				
A						
L	I	4.5				
M	n		48	2373	2497	4958
c			:	:	:	
L	h		.6	29.6	31.2	61.9
E	e	4.0				
N	s		402	1535	489	2429
G			:	:	:	
T			5.0	19.2	6.1	30.3
H	3.5					
	:	21	20	:	:	41
	:	:	:	:	:	
	:	.3	.2	:	:	.5
	3.0					
	:	:	:	:	:	
Totals	471	4023	3452	65	8011	
Percent	5.9	50.2	43.1	.8	100.0%	

Table 60. COEFFICIENTS OF CORRELATION FOR HAND MEASUREMENTS

	Hand Length	Palm Length	Hand Breadth	Hand Circumference
<b>U.S. Army Men (1966):</b>				
Hand Length	X	0.822	0.524	0.498
Palm Length	0.822	X	0.400	0.421
Hand Breadth	0.524	0.400	X	0.753
Hand Circumference	0.498	0.421	0.753	X
<b>U.S. Army Women (1977):</b>				
Hand Length	X	0.908	0.602	0.592
Palm Length	0.908	X	0.483	0.473
Hand Breadth	0.602	0.483	X	0.932
Hand Circumference	0.592	0.473	0.932	X
<b>U.S. Army Men and Women:</b>				
Hand Length	X	0.859	0.686	0.679
Palm Length	0.859	X	0.543	0.557
Hand Breadth	0.686	0.543	X	0.874
Hand Circumference	0.679	0.557	0.874	X

Table 61. REGRESSION EQUATIONS FOR HAND MEASUREMENTS

Values in Centimeters

		Standard error of estimate
<b>1 Hand Circumference and Hand Length</b>		
U.S. Army Men (1966):		
Hand Circumference	= (0.59) * Hand Length + (10.43)	0.99
Hand Length	= (0.42) * Hand Circumference + (9.83)	0.84
U.S. Army Women (1977):		
Hand Circumference	= (0.56) * Hand Length + (8.63)	0.69
Hand Length	= (0.62) * Hand Circumference + (5.94)	0.73
U.S. Army Men and Women:		
Hand Circumference	= (0.97) * Hand Length + (2.83)	1.18
Hand Length	= (0.47) * Hand Circumference + (8.76)	0.83
<b>2 Hand Circumference and Palm Length</b>		
U.S. Army Men (1966):		
Hand Circumference	= (0.76) * Palm Length + (13.54)	1.03
Palm Length	= (0.23) * Hand Circumference + (5.57)	0.57
U.S. Army Women (1977):		
Hand Circumference	= (0.78) * Palm Length + (10.78)	0.76
Palm Length	= (0.29) * Hand Circumference + (4.56)	0.46
U.S. Army Men and Women:		
Hand Circumference	= (1.34) * Palm Length + (7.04)	1.34
Palm Length	= (0.23) * Hand Circumference + (5.60)	0.56
<b>3 Hand Circumference and Hand Breadth</b>		
U.S. Army Men (1966):		
Hand Circumference	= (1.74) * Hand Breadth + (6.08)	0.75
Hand Breadth	= (0.32) * Hand Circumference + (1.88)	0.32
U.S. Army Women (1977):		
Hand Circumference	= (2.06) * Hand Breadth + (2.36)	0.31
Hand Breadth	= (0.42) * Hand Circumference + (0.02)	0.14
U.S. Army Men and Women:		
Hand Circumference	= (2.25) * Hand Breadth + (1.42)	0.78
Hand Breadth	= (0.34) * Hand Circumference + (1.58)	0.30

Table 61. REGRESSION EQUATIONS FOR HAND MEASUREMENTS

Values in Centimeters (continued)

		Standard error of estimate
<b>4 Hand Length and Palm Length</b>		
U.S. Army Men (1966):		
Hand Length = (1.26) * Palm Length + (5.68)		0.55
Palm Length = (0.54) * Hand Length + (0.39)		0.36
U.S. Army Women (1977):		
Hand Length = (1.57) * Palm Length + (1.96)		0.38
Palm Length = (0.53) * Hand Length + (0.70)		0.22
U.S. Army Men and Women:		
Hand Length = (1.44) * Palm Length + (3.64)		0.58
Palm Length = (0.51) * Hand Length + (0.89)		0.34
<b>5 Hand Length and Hand Breadth</b>		
U.S. Army Men (1966):		
Hand Length = (1.03) * Hand Breadth + (9.88)		0.82
Hand Breadth = (0.27) * Hand Length + (3.82)		0.42
U.S. Army Women (1977):		
Hand Length = (1.40) * Hand Breadth + (6.51)		0.72
Hand Breadth = (0.26) * Hand Length + (3.30)		0.31
U.S. Army Men and Women:		
Hand Length = (1.24) * Hand Breadth + (7.99)		0.82
Hand Breadth = (0.38) * Hand Length + (1.58)		0.45
<b>6 Palm Length and Hand Breadth</b>		
U.S. Army Men (1966):		
Palm Length = (0.51) * Hand Breadth + (6.03)		0.58
Hand Breadth = (0.31) * Palm Length + (5.59)		0.45
U.S. Army Women (1977):		
Palm Length = (0.65) * Hand Breadth + (4.80)		0.46
Hand Breadth = (0.36) * Palm Length + (4.27)		0.34
U.S. Army Men and Women:		
Palm Length = (0.58) * Hand Breadth + (5.40)		0.56
Hand Breadth = (0.51) * Palm Length + (3.42)		0.52

Table 62. REGRESSION EQUATIONS FOR HAND MEASUREMENTS

Values in Inches			Standard error of estimate	
<b>1 Hand Circumference and Hand Length</b>				
<b>U.S. Army Men (1966):</b>				
Hand Circumference	= (0.59)	* Hand Length + (4.09)	0.39	
Hand Length	= (0.42)	* Hand Circumference + (3.89)	0.33	
<b>U.S. Army Women (1977):</b>				
Hand Circumference	= (0.56)	* Hand Length + (3.39)	0.27	
Hand Length	= (0.62)	* Hand Circumference + (2.34)	0.29	
<b>U.S. Army Men and Women:</b>				
Hand Circumference	= (0.97)	* Hand Length + (1.11)	0.46	
Hand Length	= (0.48)	* Hand Circumference + (3.44)	0.32	
<b>2 Hand Circumference and Palm Length</b>				
<b>U.S. Army Men (1966):</b>				
Hand Circumference	= (0.76)	* Palm Length + (5.32)	0.41	
Palm Length	= (0.23)	* Hand Circumference + (2.19)	0.22	
<b>U.S. Army Women (1977):</b>				
Hand Circumference	= (0.78)	* Palm Length + (4.24)	0.30	
Palm Length	= (0.29)	* Hand Circumference + (1.79)	0.18	
<b>U.S. Army Men and Women:</b>				
Hand Circumference	= (1.34)	* Palm Length + (2.76)	0.53	
Palm Length	= (0.23)	* Hand Circumference + (2.20)	0.22	
<b>3 Hand Circumference and Hand Breadth</b>				
<b>U.S. Army Men (1966):</b>				
Hand Circumference	= (1.75)	* Hand Breadth + (2.38)	0.30	
Hand Breadth	= (0.33)	* Hand Circumference + (0.74)	0.13	
<b>U.S. Army Women (1977):</b>				
Hand Circumference	= (2.06)	* Hand Breadth + (0.92)	0.12	
Hand Breadth	= (0.42)	* Hand Circumference + (0.01)	0.06	
<b>U.S. Army Men and Women:</b>				
Hand Circumference	= (2.26)	* Hand Breadth + (0.56)	0.31	
Hand Breadth	= (0.34)	* Hand Circumference + (0.62)	0.12	

Table 62. REGRESSION EQUATIONS FOR HAND MEASUREMENTS

## Values in Inches (continued)

		Standard error of estimate
<b>4 Hand Length and Palm Length</b>		
<b>U.S. Army Men (1966):</b>		
Hand Length	= (1.26) * Palm Length + (2.23)	0.22
Palm Length	= (0.54) * Hand Length + (0.15)	0.14
<b>U.S. Army Women (1977):</b>		
Hand Length	= (1.57) * Palm Length + (0.77)	0.15
Palm Length	= (0.53) * Hand Length + (0.28)	0.09
<b>U.S. Army Men and Women:</b>		
Hand Length	= (1.45) * Palm Length + (1.42)	0.23
Palm Length	= (0.51) * Hand Length + (0.35)	0.13
<b>5 Hand Length and Hand Breadth</b>		
<b>U.S. Army Men (1966):</b>		
Hand Length	= (1.03) * Hand Breadth + (3.88)	0.32
Hand Breadth	= (0.27) * Hand Length + (1.50)	0.16
<b>U.S. Army Women (1977):</b>		
Hand Length	= (1.40) * Hand Breadth + (2.56)	0.28
Hand Breadth	= (0.26) * Hand Length + (1.30)	0.12
<b>U.S. Army Men and Women:</b>		
Hand Length	= (1.24) * Hand Breadth + (3.14)	0.32
Hand Breadth	= (0.38) * Hand Length + (0.62)	0.18
<b>6 Palm Length and Hand Breadth</b>		
<b>U.S. Army Men (1966):</b>		
Palm Length	= (0.51) * Hand Breadth + (2.37)	0.23
Hand Breadth	= (0.31) * Palm Length + (2.20)	0.18
<b>U.S. Army Women (1977):</b>		
Palm Length	= (0.65) * Hand Breadth + (1.89)	0.18
Hand Breadth	= (0.36) * Palm Length + (1.68)	0.13
<b>U.S. Army Men and Women:</b>		
Palm Length	= (0.58) * Hand Breadth + (2.12)	0.22
Hand Breadth	= (0.51) * Palm Length + (1.34)	0.21

## 10. FOREIGN ANTHROPOMETRIC DATA ON HANDS

### a. Tables of Anthropometric Data

Up to this point, comparative anthropometric data on the hand have been limited to data from the United States. However, in order to show the ranges of variation in hand size to be found in diverse populations in different parts of the world, anthropometric data on the hands of various foreign populations are presented here. The sources of these foreign data are summarized in Table 63. The number of individuals measured in each series is indicated; references for these series in the form of published reports may be found in Section 12. REFERENCES.

Data on the hand measurements of the foreign series are given in Tables 64-68. The foreign hand data are shown in the metric system, with values expressed in centimeters. Statistical values, such as means, standard deviations, and ranges, are shown in tables on the upper pages, while selected percentile values are given in tables on the lower or facing pages. An explanation of the statistical measures presented in these tables may be found in Section 6. STATISTICS (page 25).

In the statistical tables, the data are arranged in order of decreasing mean values, while in the percentile tables, the data are arbitrarily arranged in decreasing order of the 50th percentile or median value. It should be noted that the order or sequence of the series in the tables of percentile values is not necessarily the same as that in the tables of statistical values.

The foreign hand data presented here include data on Hand Length, Palm Length, Hand Breadth, Hand Circumference, and Wrist Circumference. Not all of the hand measurements were taken in all of the foreign anthropometric series cited. Data for Hand Length and Hand Breadth are available for most of the series, but data for Palm Length, Hand Circumference, and Wrist Circumference are available for only some of the source series. Minimum and maximum values, indicating the range, are not available for some of the foreign series.

The data for the Australian Armed Forces (1977) were extracted from the U.S. Air Force AMRL Data Bank. The new Australian survey was carried out in 1977, and a report is in process of publication. The raw data were supplied to the USAF AMRL Data Bank by A. Ross and K.C. Hendy of the Aeromedical Research Laboratory, Department of Defense, Melbourne, Australia.

### b. Summary of Foreign Hand Data

#### 1) Hand Length

Mean values for hand length among the samples from foreign populations range from 17.54 up to 20.49 cm. The foreign data cited here indicate a minimum hand length of 11.0 cm and a maximum hand length of 23.0 cm, giving an overall range of 12.0 cm. The stature ratios show that mean hand lengths are about ten or eleven percent of mean statures. The lowest 1st percentile value of hand length in the foreign data is 15.6 cm, while the highest

Table 63. FOREIGN ANTHROPOMETRIC SERIES ON HANDS

No.	Series	Number of individuals	Reference number
1	Australia: Armed Forces (1977)	2,945	none
2	Canada: Armed Forces (1974)	565	42
3	Canada: Canadian Forces Women (1977)	136	40
4	Canada: RCAF Navigators (1961)	290	1
5	Canada: RCAF Pilots (1961)	314	1
6	Germany: Air Force (1967-68)	1,465	27
7	Germany: Armed Forces (1970-71)	2,643	34
8	Greece: Armed Forces (1960)	1,094	29
9	Iran: Armed Forces (1968)	9,414	48
10	Italy: Armed Forces (1961)	1,358	29
11	Japan: JASDF Pilots (1972)	1,176	32
12	Latin America (1965-1970)	1,985	16
13	New Zealand: RNZAF Aircrew (1972-73)	238	56
14	South Africa: Bantu miners (1967)	485	44
15	South Africa: Armed Forces (1967)	1,442	54
16	South Korea: ROKAF Pilots (1961)	264	35
17	South Korea: Armed Forces (1965)	3,747	28
18	South Vietnam: Armed Forces (1963)	2,127	60
19	Thailand: Armed Forces (1962)	2,950	59
20	Turkey: Armed Forces (1960)	915	29
21	United Kingdom: Guardsmen (1975)	100	26
22	United Kingdom: Infantrymen (1973-74)	534	25
23	United Kingdom: Royal Armoured Corps (1972)	500	31
24	United Kingdom: RAF Aircrew (1970-71)	2,000	3

99th percentile value is 22.6 cm. A range of 7.0 cm would include 98 percent of the foreign hand lengths.

## 2) Palm Length

Mean values for palm length among the foreign samples range from 10.15 cm up to 10.97 cm. Minimum palm length in the foreign data is 8.0 cm while maximum palm length is 19.5 cm, giving an overall range of 11.5 cm for palm length. The stature ratios indicate that mean palm lengths are about six percent of mean statures. The lowest 1st percentile value for palm length is 8.8 cm, while the highest 99th percentile value is 12.3 cm, giving an overall range of 3.5 cm for 98 percent of the foreign palm lengths.

The palm length/hand length index shows the relative proportions between the palm of the hand and the length of the middle finger. In the foreign data, this index ranges from 55.6 up to 57.9, indicating that palm length is between 55.6 to 57.9 percent of hand length. Thus, the length of the middle finger is from 44.4 to 42.1 percent of hand length. Most palm length/hand length indices are between 56 and 57 percent in the foreign data.

## 3) Hand Breadth

Mean values for hand breadth among the foreign samples range from 8.01 cm up to 9.01 cm. Minimum hand breadth in the foreign data is 6.1 cm and maximum hand breadth is 11.0 cm, giving an overall range of 4.9 cm for hand breadth. The stature ratios indicate that mean hand breadths are about five percent of mean stature values. The lowest 1st percentile value for hand breadth is 7.0 cm and the highest 99th percentile value is 10.1 cm, giving an overall range of 4.1 cm for 98 percent of the foreign data for hand breadth.

The hand breadth/hand length index is an indication of hand proportions; a low index shows a narrow hand relative to length, while a high index indicates a broad hand relative to length. The hand breadth/hand length index for the foreign hand data ranges from 42.9 to 47.2, while most of the foreign samples have indices between 44 and 47 percent.

## 4) Hand Circumference

Mean values for hand circumference range from 20.16 cm up to 21.89 cm in the foreign hand data. Minimum hand circumference in the foreign data is 10.0 cm, while maximum hand circumference is 26.7 cm, giving an overall range of 15.8 cm in hand circumference. The stature ratios for hand circumference indicate that mean hand circumferences are slightly over 12 percent of mean statures. The lowest 1st percentile value for hand circumference in the foreign data is 18.2 cm, while the highest 99th percentile value is 24.4 cm; thus a range of 6.2 cm would cover 98 percent of the hand circumference values shown in the foreign data.

The hand circumference/hand length index for the foreign data ranges from 110.2 to 115.8, indicating that hand circumference is about 110 to 115 percent of hand length. This index is between 113 and 115 percent for most of the foreign series.

Table 64a. STATISTICAL VALUES FOR HAND LENGTH - FOREIGN DATA

No.	Series	N	Values in Centimeters						Stature ratio	
			Mean	SE(4)	S.D.	SE(3D)	V(%)	Min.	Max.	
1	United Kingdom: Guardsmen (1975)	100	20.49	0.10	0.98	0.07	4.78	18.2	23.2	5.0
2	United Kingdom: RAC <sup>a</sup> (1972)	500	19.65	0.04	0.85	0.03	4.35	17.0	22.5	5.5
3	U. K.: Infantrymen (1973-74)	534	19.50	0.04	0.85	0.03	4.35	17.5	22.2	4.7
4	Canada: Armed Forces (1974)	565	19.20	0.04	0.88	0.03	4.58	16.0	22.5	6.5
5	South Africa: Armed Forces (1967)	1442	19.18	0.02	0.84	0.02	4.38			.109
6	Australia: Armed Forces (1977)	2945	19.16	0.02	0.85	0.01	4.44			.110
7	Canada: RCAF <sup>b</sup> Pilots (1961)	314	19.00	0.05	0.94	0.04	4.95	13.0	22.0	9.0
8	South Africa: Bantu miners (1967)	485	18.98	0.05	1.04	0.03	5.48			.107
9	Italy: Armed Forces (1960)	1358	18.96	0.02	0.86	0.01	4.52			.112
10	Germany: Air Force (1967-68)	1465	18.91	0.02	0.87	0.02	4.60	15.0	22.1	7.1
11	Canada: RCAF <sup>b</sup> Navigators (1961)	290	18.87	0.05	0.86	0.04	4.56	13.0	22.0	9.0
12	Turkey: Armed Forces (1960)	915	18.83	0.03	0.83	0.02	4.39			.107
13	Greece: Armed Forces (1960)	1084	18.80	0.03	0.83	0.02	4.43			.111
14	Iran: Armed Forces (1968)	9414	18.68	0.01	0.86	0.01	4.60	15.5	22.3	6.8
										.112

<sup>a</sup>Royal Armoured Corps; <sup>b</sup>Royal Canadian Air Force

Table 64b. PERCENTILE VALUES FOR HAND LENGTH - FOREIGN DATA

No.	Series	Percentiles in Centimeters <sup>a</sup>							Range 29th (1st-99th)	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>		
1	United Kingdom: Guardsmen ('75)	18.2	18.8	19.0	19.2	19.6	20.4	21.1	21.9	22.0
2	United Kingdom: RAC <sup>a</sup> (1972)	17.6	17.9	18.2	18.5	19.0	19.6	20.2	20.7	21.0
3	U. K.: Infantrymen (1973-74)	17.6	17.8	18.1	18.4	18.7	19.4	20.0	20.5	20.9
4	Canada: Armed Forces (1974)	17.0	17.4	17.7	18.1	18.6	19.2	19.8	20.3	20.7
5	Australia: Armed Forces (1977)	17.2	17.5	17.8	18.1	18.6	19.2	19.7	20.3	20.6
6	So. Africa: Armed Forces (1967)	17.2	17.5	17.7	18.1	18.5	19.1	19.6	20.1	20.3
7	Canada: RCAF <sup>b</sup> Pilots (1961)	16.6	16.9	17.6	17.8	18.5	19.0	19.6	20.2	20.4
8	So. Africa: Bantu miners (1967)	16.8	17.0	17.4	17.7	18.3	18.9	19.5	20.1	20.5
9	Canada: RCAF <sup>b</sup> Navigators (1961)	16.7	16.8	17.2	17.6	18.3	18.9	19.4	20.1	20.4
10	Italy: Armed Forces (1961)	17.0	17.2	17.6	17.9	18.4	18.9	19.5	20.1	20.4
11	Germany: Air Force (1967-68)	16.9	17.1	17.5	17.8	18.3	18.9	19.5	20.0	20.3
12	Greece: Armed Forces (1960)	16.9	17.2	17.5	17.8	18.2	18.8	19.3	19.9	20.2
13	Turkey: Armed Forces (1960)	17.0	17.2	17.5	17.8	18.2	18.8	19.4	19.9	20.3
14	Iran: Armed Forces (1968)	16.8	17.0	17.3	17.6	18.1	18.7	19.2	19.8	20.2

<sup>a</sup>Royal Armoured Corps; <sup>b</sup>Royal Canadian Air Force

Table 64a. STATISTICAL VALUES FOR HAND LENGTH - FOREIGN DATA (continued)

No.	Series	N	Mean	Values in Centimeters				Range	Max.	Total	Stature ratio
				SE(M)	S.D.	SE(SD)	V(%)				
15	South Korea: ROKAF <sup>a</sup> Pilots (1961)	264	18.46	0.05	0.77	0.03	4.16	16.1	20.6	4.5	.109
16	Germany: Armed Forces (1970-71)	2643	18.40	0.02	1.00	0.01	5.43	•	•	•	.105
17	South Korea: Armed Forces (1965)	3747	18.10	0.01	0.70	0.01	4.20	•	•	•	.110
18	Latin America <sup>b</sup> (1965-1970)	1985	18.10	0.02	0.90	0.01	5.00	11.0	23.0	12.0	.109
19	Thailand: Armed Forces (1962)	2950	18.00	0.01	0.80	0.01	4.40	15.4	21.4	6.0	.110
20	So. Vietnam: Armed Forces (1963)	2127	17.54	0.02	0.82	0.01	4.68	14.9	20.3	5.4	.109
21	Canadian Forces Women (1977)	136	17.38	0.08	0.69	0.05	5.12	15.2	20.6	5.4	.107

<sup>a</sup>Republic of Korea Air Force; <sup>b</sup>Composite sample from Armed Forces of 18 Central and South American countries

Table 64b. PERCENTILE VALUES FOR HAND LENGTH - FOREIGN DATA (continued)

No.	Series	Percentiles in Centimeters								Range 99th (1st-99th)	
		1st	2nd	5th	10th	25th	Median	75th	90th		
15	Germany: Armed Forces ('70-'71)	16.1	16.4	16.8	17.3	17.8	18.3	19.0	19.6	20.0	20.5
16	Latin America <sup>a</sup> (1965-1970)	16.2	16.4	16.8	17.1	17.6	18.1	18.7	19.3	19.8	20.1
17	So. Korea: ROKAF <sup>b</sup> Pilots ('61)	16.5	16.8	16.9	17.1	17.6	18.1	18.7	19.1	19.4	19.9
18	So. Korea: Armed Forces (1965)	16.3	16.5	16.9	17.1	17.5	18.1	18.6	19.0	19.3	19.5
19	Thailand: Armed Forces (1962)	16.1	16.3	16.6	17.0	17.4	18.0	18.6	19.1	19.4	19.7
20	So. Vietnam: Armed Forces ('63)	15.6	15.8	16.2	16.5	17.0	17.5	18.1	18.6	18.9	19.2
21	Canadian Forces Women (1977)	15.2	15.5	15.9	16.1	16.6	17.2	17.8	18.5	18.8	19.1
											19.3
											4.1

<sup>a</sup>Composite sample from Armed Forces of 18 Central and South American countries; <sup>b</sup>Republic of Korea Air Force

Table 65a. STATISTICAL VALUES FOR PALM LENGTH - FOREIGN DATA

No.	Series	N	Mean	Values in Centimeters				Range	Max.	Total	Stature ratio
				SE(M)	S.D.	SE(SD)	V(S)				
1	Australia: Armed Forces (1977)	2942	10.97	0.01	0.53	0.01	4.83				.063
2	South Africa: Bantu miners (1967)	485	10.81	0.03	0.61	0.02	5.64				.064
3	South Africa: Armed Forces (1967)	1442	10.76	0.01	0.51	0.01	4.74				.061
4	Italy: Armed Forces (1961)	1358	10.73	0.01	0.54	0.00	4.99				.063
5	Turkey: Armed Forces (1960)	915	10.70	0.02	0.51	0.01	4.79				.063
6	Greece: Armed Forces (1960)	1084	10.58	0.02	0.53	0.01	5.00				.062
7	Germany: Air Force (1967-68)	1465	10.54	0.02	0.63	0.01	5.98				.060
8	Japan: JASDF <sup>a</sup> Pilots (1972)	1176	10.53	0.02	0.59	0.01	5.60				.063
9	Iran: Armed Forces (1968)	944	10.45	0.01	0.52	0.00	5.01				.063
10	Thailand: Armed Forces (1962)	2950	10.40	0.01	0.50	0.01	4.81				.064
11	South Korea: Armed Forces (1965)	3747	10.30	0.01	0.50	0.01	4.85				.062
12	Latin America <sup>b</sup> (1965-1970)	1985	10.30	0.01	0.60	0.01	5.82				.062
13	South Korea: ROKAF <sup>c</sup> Pilots (1961)	264	10.26	0.03	0.56	0.02	5.46				.061
14	Sp. Vietnam: Armed Forces (1963)	2127	10.15	0.01	0.52	0.01	5.12				.063

a Japanese Air Self Defense Force; b Composite sample from Armed Forces of 18 Central and South American countries; c Republic of Korea Air Force

Table 65b. PERCENTILE VALUES FOR PALM LENGTH - FOREIGN DATA

No.	Series	Percentiles in Centimeters							Range <u>99th (1st-99th)</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>Median</u>	<u>20th</u>	<u>25th</u>				
1	Australia: Armed Forces (1977)	9.8	9.9	10.1	10.3	10.6	11.0	11.3	11.7	11.9	12.1	12.3	2.5
2	So. Africa: Bantu miners (1967)	9.6	9.7	9.9	10.1	10.4	10.7	11.1	11.5	11.7	12.0	12.2	2.6
3	Italy: Armed Forces (1961)	9.5	9.6	9.9	10.1	10.4	10.7	11.1	11.4	11.6	11.9	12.0	2.5
4	Turkey: Armed Forces (1960)	9.6	9.7	9.9	10.0	10.3	10.7	11.0	11.4	11.6	11.8	11.9	2.3
5	Germany: Air Force (1967-68)	9.2	9.3	9.5	9.7	10.1	10.6	11.0	11.4	11.6	11.8	12.0	2.8
6	So. Africa: Armed Forces (1967)	9.6	9.7	9.9	10.0	10.2	10.6	10.9	11.3	11.5	11.8	12.0	2.4
7	Greece: Armed Forces (1960)	9.3	9.5	9.7	9.9	10.2	10.6	10.9	11.3	11.5	11.7	11.8	2.5
8	Japan: JASDFA Pilots (1972)	9.2	9.4	9.6	9.8	10.1	10.5	10.9	11.3	11.5	11.8	12.0	2.7
9	Iran: Armed Forces (1968)	9.2	9.4	9.6	9.8	10.1	10.4	10.8	11.1	11.3	11.5	11.7	2.6
10	Thailand: Armed Forces (1962)	9.1	9.3	9.5	9.7	10.0	10.4	10.8	11.1	11.3	11.5	11.7	2.5
11	Latin America <sup>b</sup> (1965-1970)	9.1	9.2	9.4	9.6	10.0	10.3	10.7	11.1	11.3	11.6	11.8	2.7
12	So. Korea: Armed Forces (1965)	8.8	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.1	11.4	11.7	2.9
13	So. Korea: ROKAF <sup>c</sup> Pilots (1961)	9.1	9.2	9.4	9.6	9.9	10.2	10.6	10.9	11.2	11.6	12.2	3.1
14	So. Vietnam: Armed Forces (1963)	8.9	9.0	9.2	9.4	9.7	10.1	10.5	10.8	11.0	11.2	11.4	2.5

<sup>a</sup>Japanese Air Self Defense Force; <sup>b</sup>Composite sample from Armed Forces of 18 Central and South American countries;

<sup>c</sup>Republic of Korea Air Force

Table 66a. STATISTICAL VALUES FOR HAND BREATH - FOREIGN DATA

No.	Series	N	Mean	Values in Centimeters				Range Min.	Range Max.	Total	Stature ratio
				SE(M)	S.D.	SE(3D)	V(%)				
1	United Kingdom: Guardsmen (1975)	100	9.01	0.05	0.47	0.03	5.23	8.0	10.3	2.3	.050
2	Canada: Armed Forces (1974)	565	8.91	0.02	0.45	0.01	5.05	7.5	11.0	3.5	.051
3	Italy: Armed Forces (1960)	1358	8.89	0.01	0.44	0.00	5.00				.052
4	South Africa: Armed Forces (1967)	1446	8.89	0.01	0.45	0.01	5.06				.051
5	Greece: Armed Forces (1960)	1084	8.77	0.01	0.42	0.01	4.82				.051
6	Iran: Armed Forces (1968)	9414	8.73	0.00	0.42	0.00	4.78	6.9	10.9	4.6	.052
7	Turkey: Armed Forces (1960)	915	8.65	0.01	0.42	0.01	4.90				.051
8	Canada: RCAF <sup>a</sup> Pilots (1961)	314	8.59	0.03	0.51	0.02	5.94	7.1	10.3	3.2	.048
9	Germany: Air Force (1967-68)	1467	8.58	0.01	0.44	0.01	5.09	7.0	10.3	3.3	.048
10	United Kingdom: RAC <sup>b</sup> (1972)	500	8.57	0.02	0.45	0.01	5.25	7.3	10.0	2.7	.049
11	U. K.: Infantrymen (1973-74)	533	8.56	0.02	0.42	0.01	4.91	7.3	9.8	2.5	.049
12	South Africa: Bantu miners (1967)	485	8.52	0.02	0.43	0.01	5.05				.050
13	South Korea: Armed Forces (1965)	3737	8.50	0.01	0.40	0.00	4.90				.051
14	Thailand: Armed Forces (1962)	2950	8.50	0.01	0.40	0.01	4.70	6.9	10.2	3.3	.052

<sup>a</sup>Royal Canadian Air Force; <sup>b</sup>Royal Armoured Corps

Table 66b. PERCENTILE VALUES FOR HAND BREADTH - FOREIGN DATA

No.	Series	Percentiles in Centimeters							Range 29th (1st-99th)				
		1st	2nd	5th	10th	25th	50th	75th					
1	Canada: Armed Forces (1974)	7.8	8.0	8.1	8.3	8.6	9.0	9.2	9.5	9.6	9.8	10.0	2.2
2	United Kingdom: Guardsmen ('75)	8.0	8.0	8.2	8.4	8.6	8.9	9.3	9.6	9.8	9.9	10.1	2.1
3	Italy: Armed Forces	7.9	8.0	8.2	8.3	8.6	8.9	9.2	9.5	9.6	9.8	9.9	2.0
4	So. Africa: Armed Forces (1967)	7.8	7.9	8.1	8.3	8.5	8.8	9.1	9.3	9.5	9.7	9.8	2.0
5	Greece: Armed Forces (1960)	7.9	8.0	8.1	8.3	8.5	8.8	9.0	9.3	9.5	9.7	9.8	1.9
6	Iran: Armed Forces (1968)	7.8	7.9	8.0	8.2	8.4	8.7	9.0	9.3	9.4	9.6	9.7	1.9
7	Turkey: Armed Forces (1960)	7.6	7.8	8.0	8.1	8.4	8.6	8.9	9.2	9.4	9.6	9.6	2.0
8	Germany: Air Force (1967-68)	7.5	7.7	7.9	8.1	8.3	8.6	8.9	9.2	9.3	9.5	9.6	2.1
9	Canada: RCAF Pilots (1961)	7.5	7.6	8.0	8.0	8.2	8.5	9.0	9.2	9.4	9.6	9.7	2.2
10	United Kingdom: RAC <sup>b</sup> (1972)	7.6	7.7	7.8	8.0	8.2	8.5	8.8	9.1	9.3	9.6	9.7	2.1
11	So. Korea: Armed Forces (1965)	7.5	7.6	7.8	8.0	8.2	8.5	8.7	9.0	9.1	9.4	9.7	2.2
12	U. K.: Infantrymen (1973-74)	7.5	7.7	7.8	8.0	8.2	8.5	8.8	9.0	9.2	9.4	9.6	2.1
13	Thailand: Armed Forces (1962)	7.4	7.5	7.7	7.9	8.2	8.4	8.8	9.1	9.2	9.4	9.6	2.2
14	So. Africa: Bantu miners (1957)	7.3	7.4	7.6	7.8	8.1	8.4	8.7	9.0	9.1	9.3	9.5	2.2

<sup>a</sup>Royal Canadian Air Force; <sup>b</sup>Royal Armoured Corps

Table 36a. STATISTICAL VALUES FOR HAND BREADTH - FOREIGN DATA (continued)

No.	Series	N	Mean	Values in Centimeters			Range	Total	Stature ratio	
				SE(M)	S.D.	V(%)				
15	Germany: Armed Forces (1970-71)	2643	8.50	0.01	0.40	0.01	4.71		.649	
16	Canada: RCAFA Navigators (1961)	290	8.43	0.03	0.51	0.02	6.05	7.1	10.3	3.2
17	Latin America <sup>b</sup> (1965-1970)	1985	8.40	0.01	0.40	0.01	4.80	6.3	9.9	3.6
18	Japan: JASDFC Pilots (1972)	1176	8.40	0.01	0.42	0.01	5.00			.650
19	South Korea: ROKAFD Pilots (1961)	264	8.36	0.02	0.37	0.02	4.47	6.1	9.2	3.1
20	Australia: Armed Forces (1977)	2945	8.22	0.01	0.43	0.01	5.23			.647
21	So. Vietnam: Armed Forces (1963)	2125	8.01	0.01	0.43	0.01	5.37	6.3	9.6	3.3
22	Canadian Forces Women (1977)	137	8.01	0.03	0.38	0.02	4.74	7.1	9.0	1.9

<sup>a</sup>Royal Canadian Air Force; <sup>b</sup>Composite sample from Armed Forces of 18 Central and South American countries;<sup>c</sup>Japanese Air Self Defense Force; Republic of Korea Air Force

Table 66b. PERCENTILE VALUES FOR HAND BREADTH - FOREIGN DATA (continued)

No.	Series	Percentiles in Centimeters							Range 29th (1st-99th)				
		1st	2nd	5th	10th	25th	50th	75th					
15	Canada: RCAF <sup>a</sup> Navigators (1961)	7.2	7.4	7.5	8.0	8.1	8.4	8.7	9.1	9.2	9.5	9.6	2.4
16	Latin America <sup>b</sup> (1965-1970)	7.5	7.6	7.8	7.9	8.1	8.4	8.7	9.0	9.0	9.2	9.4	2.5
17	Germany: Armed Forces ('70-71)	7.6	7.7	7.9	8.0	8.2	8.4	8.8	9.0	9.1	9.3	9.4	1.8
18	Japan: JASDF <sup>c</sup> Pilots (1972)	7.5	7.6	7.8	7.9	8.1	8.4	8.7	8.9	9.1	9.3	9.4	1.9
19	So. Korea: ROKAF <sup>d</sup> Pilots ('61)	7.4	7.6	7.8	7.9	8.1	8.4	8.6	8.8	9.0	9.1	9.2	1.8
20	Australia: Armed Forces (1977)	7.2	7.3	7.5	7.7	7.9	8.2	8.5	8.8	8.9	9.1	9.3	2.1
21	So. Vietnam: Armed Forces ('63)	7.0	7.1	7.3	7.4	7.7	8.0	8.3	8.5	8.7	8.9	9.0	2.0
22	Canadian Forces Women (1977)	7.1	7.2	7.3	7.5	7.7	7.9	8.2	8.5	8.6	8.8	8.9	1.8

<sup>a</sup>Royal Canadian Air Force; <sup>b</sup>Composite sample from Armed Forces of 18 Central and South American countries;  
<sup>c</sup>Japanese Air Self Defense Force; <sup>d</sup>Republic of Korea Air Force

Table 67a. STATISTICAL VALUES FOR HAND CIRCUMFERENCE - FOREIGN DATA

No.	Series	N	Mean	Values in Centimeters				Range	Max.	Total	Statute ratio
				SE(M)	S.D.	SE(SD)	$\bar{Y}(\bar{S})$				
1	Canada: RCAF <sup>a</sup> Pilots (1961)	314	21.89	0.06	1.04	0.04	4.75	19.0	24.8	5.8	.123
2	South Africa: Armed Forces (1967)	1448	21.83	0.03	1.04	0.02	4.76				.125
3	Canada: RCAF <sup>a</sup> Navigators (1961)	290	21.72	0.06	1.07	0.04	4.93	19.0	24.8	5.8	.123
4	Italy: Armed Forces (1961)	1358	21.56	0.03	1.01	0.02	4.68				.126
5	Germany: Air Force (1967-68)	1464	21.45	0.03	1.32	0.02	6.13	17.2	25.9	8.7	.121
6	Germany: Armed Forces (1970-71)	2643	21.30	0.02	1.00	0.01	4.69				.122
7	Greece: Armed Forces (1960)	1084	21.25	0.03	1.07	0.02	5.04				.125
8	Iran: Armed Forces (1968)	9414	21.13	0.01	1.06	0.01	5.03	17.0	26.0	9.0	.127
9	South Korea: Armed Forces (1965)	3747	20.80	0.02	1.20	0.01	6.26				.126
10	Latin America <sup>b</sup> (1965-1970)	1985	20.80	0.03	1.20	0.02	5.80	10.9	26.7	15.8	.125
11	Turkey: Armed Forces (1960)	915	20.76	0.03	1.00	0.02	4.82				.123
12	Japan: JASDF <sup>c</sup> Pilots (1972)	1176	20.16	0.03	0.91	0.02	4.51				.122

<sup>a</sup>Royal Canadian Air Force; <sup>b</sup>Composite sample from Armed Forces of 18 Central and South American countries;<sup>c</sup>Japanese Air Self Defense Force

Table 67b. PERCENTILE VALUES FOR HAND CIRCUMFERENCE - FOREIGN DATA

No.	Series	Percentiles in Inches							Range <u>1st-99th</u>				
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>					
1	Canada: RCAF <sup>a</sup> Pilots (1961)	19.5	19.7	20.1	20.6	21.1	21.9	22.6	23.3	23.7	24.1	24.3	4.8
2	So. Africa: Armed Forces (1967)	19.4	19.7	20.0	20.4	21.1	21.8	22.4	23.0	23.3	23.8	24.1	4.7
3	Canada: RCAF <sup>a</sup> Navigators (1961)	19.1	19.5	20.0	20.3	20.9	21.7	22.4	23.1	23.6	24.1	24.3	5.2
4	Germany: Air Force (1967-68)	18.2	18.6	19.2	19.7	20.6	21.5	22.4	23.1	23.6	24.1	24.4	5.2
5	Italy: Armed Forces (1961)	19.4	19.6	19.9	20.3	20.9	21.5	22.2	22.9	23.3	23.7	24.1	4.7
6	Greece: Armed Forces (1960)	19.0	19.2	19.5	19.9	20.5	21.2	22.0	22.7	23.1	23.5	23.8	4.8
7	Germany: Armed Forces (1970-71)	19.0	19.4	19.9	20.1	20.6	21.2	22.0	22.6	22.9	23.4	23.8	4.8
8	Iran: Armed Forces (1968)	18.6	18.9	19.4	19.8	20.5	21.2	21.8	22.5	22.9	23.4	23.8	5.2
9	Latin America <sup>b</sup> (1965-1970)	18.4	18.6	19.0	19.4	20.0	20.8	21.5	22.4	22.9	23.6	24.1	5.7
10	Turkey: Armed Forces (1960)	18.5	18.8	19.2	19.5	20.1	20.7	21.4	22.1	22.5	23.0	23.2	4.7
11	So. Korea: Armed Forces (1965)	18.4	18.8	19.2	19.5	20.0	20.6	21.3	21.9	22.4	24.2	26.5	8.1
12	Japan: JASDF <sup>c</sup> Pilots (1972)	18.3	18.5	18.8	19.0	19.5	20.1	20.7	21.3	21.7	22.1	22.4	4.1

<sup>a</sup>Royal Canadian Air Force; <sup>b</sup>Composite sample from Armed Forces of 18 Central and South American countries;<sup>c</sup>Japanese Air Self Defense Force

Table 68a. STATISTICAL VALUES FOR WRIST CIRCUMFERENCE - FOREIGN DATA

No.	Series	Values in Centimeters						Shuttle ratio			
		<u>N</u>	<u>Mean</u>	<u>SE(M)</u>	<u>S.D.</u>	<u>SE(SD)</u>	<u>V(%)</u>	<u>Min.</u>	<u>Max.</u>	<u>Total</u>	
1	Germany: Air Force (1967-68)	1465	17.84	0.02	0.88	0.02	4.96	15.2	21.1	5.9	.101
2	New Zealand: RNZAF <sup>a</sup> (1972-73)	238	17.56	0.05	0.82	0.04	4.68	15.3	20.0	4.7	.099
3	Germany: Armed Forces (1970-71)	2643	17.40	0.02	0.80	0.01	4.60				.100
4	United Kingdom: RAF <sup>b</sup> (1970-71)	1999	17.39	0.02	0.95	0.02	5.44	14.6	21.0	6.4	.098
5	Italy: Armed Forces (1961)	1358	17.38	0.02	0.86	0.01	4.95				.102
6	South Africa: Armed Forces (1967)	1440	17.37	0.03	1.12	0.02	6.45				.099
7	Turkey: Armed Forces (1960)	915	16.95	0.03	0.84	0.02	4.96				.100
8	Canada: RCAF <sup>c</sup> Pilots (1961)	314	16.84	0.04	0.76	0.03	4.51	14.0	19.7	5.7	.095
9	Greece: Armed Forces (1960)	1084	16.81	0.02	0.74	0.02	4.40				.098
10	Canada: RCAF <sup>c</sup> Navigators (1961)	290	16.74	0.05	0.81	0.03	4.84	14.0	19.7	5.7	.095
11	South Korea: ROKAF <sup>d</sup> Pilots (1961)	264	16.68	0.05	0.77	0.03	4.61	14.0	20.0	6.0	.099
12	Iran: Armed Forces (1968)	944	16.67	0.01	0.93	0.01	5.55	13.5	20.5	7.0	.100
13	Japan: JASDF <sup>e</sup> Pilots (1972)	1176	16.58	0.02	0.73	0.02	4.40				.100
14	South Korea: Armed Forces (1965)	3747	16.40	0.01	0.90	0.01	5.90				.099

<sup>a</sup>Royal New Zealand Air Force; <sup>b</sup>Royal Air Force; <sup>c</sup>Royal Canadian Air Force; <sup>d</sup>Republic of Korea Air Force;  
<sup>e</sup>Japanese Air Self Defense Force

Table 68b. PERCENTILE VALUES FOR WRIST CIRCUMFERENCE - FOREIGN DATA

No.	Series	Percentiles in Centimeters							Range 29th (1st-99th)
		1st	2nd	5th	10th	25th	50th	75th	
1	Germany: Air Force (1967-68)	15.8	16.1	16.5	16.8	17.2	17.8	18.4	19.4 20.0 4.2
2	New Zealand: RNZAF <sup>a</sup> (1972-73)	15.9	16.1	16.3	16.5	17.0	17.5	18.1	19.0 19.7 3.8
3	Italy: Armed Forces (1961)	15.4	15.6	16.0	16.3	16.8	17.4	17.9	18.5 19.6 4.2
4	United Kingdom: RAF <sup>b</sup> (1970-71)	15.4	15.5	15.9	16.2	16.7	17.3	18.0	18.6 19.0 19.7 4.3
5	Germany: Armed Forces (1970-71)	15.6	15.8	16.1	16.4	16.9	17.3	17.9	18.3 19.1 19.3 3.7
6	So. Africa: Armed Forces (1967)	15.1	15.3	15.7	16.0	16.5	17.2	17.9	18.6 19.0 19.6 20.0 4.9
7	Turkey: Armed Forces (1960)	15.0	15.2	15.6	15.9	16.4	16.9	17.5	18.1 18.4 18.8 19.0 4.0
8	Canada: RCAF <sup>c</sup> Pilots (1961)	15.2	15.5	15.6	15.8	16.3	16.9	17.4	17.9 18.1 18.5 18.8 3.6
9	Greece: Armed Forces (1960)	15.1	15.3	15.6	15.8	16.2	16.8	17.3	17.8 18.1 18.4 18.7 3.6
10	Canada: RCAF <sup>c</sup> Navigators (1961)	14.9	15.1	15.6	15.7	16.2	16.7	17.2	17.7 18.1 18.6 19.3 4.4
11	Iran: Armed Forces (1968)	14.6	14.8	15.2	15.6	16.1	16.7	17.3	17.8 18.2 18.7 19.0 4.4
12	So. Korea: ROKAF <sup>d</sup> Pilots ('61)	14.7	15.1	15.6	15.8	16.2	16.6	17.2	17.7 18.0 18.7 19.0 4.3
13	Japan: JASDF <sup>e</sup> Pilots (1972)	15.1	15.3	15.5	15.7	16.1	16.5	17.0	17.5 17.8 18.2 18.4 3.3
14	So. Korea: Armed Forces (1965)	14.1	14.7	15.0	15.4	15.9	16.4	17.0	17.5 17.9 18.4 18.6 4.5

<sup>a</sup>Royal New Zealand Air Force; <sup>b</sup>Royal Air Force; <sup>c</sup>Royal Canadian Air Force; <sup>d</sup>Republic of Korea Air Force; <sup>e</sup>Japanese Air Self Defense Force

Table 68a. STATISTICAL VALUES FOR WRIST CIRCUMFERENCE - FOREIGN DATA (continued)

No.	Series	Values in Centimeters						Range			Statute ratio
		<u>N</u>	<u>Mean</u>	<u>SE(N)</u>	<u>S.D.</u>	<u>SE(3D)</u>	<u>V(%)</u>	<u>Min.</u>	<u>Max.</u>	<u>Total</u>	
15	Latin America <sup>a</sup> (1965-1970)	1985	16.20	0.02	0.90	0.01	5.60	10.8	27.7	16.9	.097
16	Thailand: Armed Forces (1962)	2950	15.70	0.02	0.90	0.01	5.50	12.5	29.0	6.5	.096
17	So. Vietnam: Armed Forces (1963)	2128	14.90	0.02	0.88	0.01	5.91	12.5	18.5	6.0	.093

<sup>a</sup>Composite sample from Armed Forces of 18 Central and South American countries

Table 68b. PERCENTILE VALUES FOR WRIST CIRCUMFERENCE - FOREIGN DATA (continued)

No.	Series	Percentiles in Centimeters									Range <u>29th (1st-29th)</u>	
		<u>1st</u>	<u>2nd</u>	<u>5th</u>	<u>10th</u>	<u>25th</u>	<u>50th</u>	<u>75th</u>	<u>90th</u>	<u>25th</u>		
15	Latin America <sup>a</sup> (1965-1970)	14.2	14.5	14.9	15.1	15.6	16.2	16.9	17.4	17.9	18.4	18.7
16	Thailand: Armed Forces (1962)	13.7	13.9	14.3	14.6	15.1	15.6	16.2	16.7	17.0	17.4	17.7
17	So. Vietnam: Armed Forces ('63)	12.9	13.0	13.5	13.8	14.2	14.9	15.4	16.0	16.4	16.6	17.0
											4.1	

<sup>a</sup>Composite sample from Armed Forces of 18 Central and South American countries

## 11. HANDS AND HANDWEAR

### a. Historical Background

Even a brief review of the history and development of gloves and other types of handwear is beyond the scope of this report. However, since the primary reason for the analysis of anthropometric data on measurements of the hands is to provide a basis for the design and satisfactory sizing of handwear, a discussion of the basis for the sizing of handwear is relevant. What are the origins of attempts to provide handwear in sizes which fit the hands adequately?

For a long period of time during the early history of handwear, gloves were made and sewn by hand. While most gloves were made to order to fit the buyer's hands, the fit achieved in these gloves left much to be desired. Apparently, most gloves were too long, too wide, and with fingers which did not fit at all.

An informative, if somewhat rambling account of the origins and development of handwear may be found in a popular book by Bill Severn (1965)<sup>16</sup> entitled *Hand in Glove*. The author discusses the history of gloves, customs associated with gloves, and the early manufacture of gloves in England and France, as well as the establishment of the glove industry in this country at Gloversville, Fulton County, New York.

The following quotation from Severn's book (pages 68-69) is an interesting account of what seems to be the first attempt to standardize the sizing of gloves.

"By the late eighteenth century, some people who were wealthy enough to afford it had their gloves made on wooden models of their hands. The hand-lasting of gloves borrowed the method shoemakers used to form and stretch leather. In Philadelphia in 1790, artisan glovers who catered to the bewigged leaders of the new Federalist society used polished hand forms that were individually modeled and carved for each client so gloves could be precisely fitted with craftsman-like care. However, most gloves, in Europe as well as in America, remained poorly fitted, cut from a haphazard assortment of flat patterns that varied in sizes and styles from one glover to the next. Widths were narrow or broad and thumbs and fingers short or long according to the patterns each maker happened to adopt. Several attempts were made to create patterns and cutting dies that would produce gloves in uniform sizes, but there was no really scientific approach to the problem until a young French medical student became interested in it.

"The student was Xavier Jouvin, whose home was in Grenoble, the French city long famous for its gloves. Jouvin's studies of medicine gave him an interest in anatomy and, living where he did, he constantly heard talk of the glove industry and its problems. Inventive by nature, inclined to dabble with mechanical devices as well as to pursue a search for knowledge in many branches of science, he later

<sup>16</sup>Severn, B. *Hand in Glove*. David McKay Co., New York, N.Y., 1965.

created an automatic planisphere to show the positions of the stars and planets. But his greatest contribution to human comfort was his investigation of hands and gloves. His work eventually led to a complete change in methods of measurement and manufacture so that people finally could have gloves that fit.

"Jouvin made a thorough study of the human hand, detailed and comparative measurements of the width, finger length and other dimensions of hundreds of hands, and ultimately classified 320 sizes and shapes of gloves. These were standardized into patterns from which dies were made. He failed at first to win much recognition for his labors, but in 1839 Jouvin's system was awarded a bronze medal at the Industrial Exhibition held in Paris and soon was adopted by the French glove trade. Glovers in other countries gradually accepted the system and it provided the basis upon which gloves have been measured ever since."

Severn's book also contains a useful and interesting list of books about gloves, including publications of the National Association of Glove Manufacturers, Gloversville, New York.

#### b. Research on Hands and Handwear

Needless to say, a great deal of research and development work has been carried out over a period of some years by the U.S. Armed Forces in order to provide adequate protection for the hands. The U.S. Army has been concerned primarily with the development of insulated handwear for protection of the hands against the cold, while the U.S. Air Force has concentrated primarily on the development of handwear for use with pressure suits worn by aircrewmen at high altitudes.

A general discussion of problems of environmental protection, including the hands and handwear, may be found in the book edited by Newburgh (1949)<sup>17</sup> entitled **Physiology of Heat Regulation and the Science of Clothing**. A second reference, dealing specifically with problems in the cold, is entitled **Man Living in the Arctic**, edited by Fisher and published by the National Academy of Sciences — National Research Council in 1961.<sup>18</sup> Another useful reference on hands and handwear, also edited by Fisher and published by the National Academy of Sciences — National Research Council in 1957, is entitled **Protection and Functioning of the Hands in Cold Climates**.<sup>19</sup>

<sup>17</sup> Newburgh, L.H. (ed.). **Physiology of Heat Regulation and the Science of Clothing**. W.B. Saunders Co., Philadelphia, Pennsylvania, 1949.

<sup>18</sup> Fisher, F.R. (ed.). **Man Living in the Arctic**. National Academy of Sciences — National Research Council, Washington, D.C., 1961.

<sup>19</sup> Fisher, F.R. (ed.). **Protection and Functioning of the Hands in Cold Climates**. National Academy of Sciences — National Research Council, Washington, D.C., 1957.

Several specific studies may be cited and reviewed here as examples of various efforts which have been made in attempts to improve the performance and functioning of military handwear.

In an attempt to provide designers and engineers with information on the sizes of the gloved hand, Kobrick (1956 and 1957)<sup>20,21</sup> published two handbooks in which various types of U.S. Army handwear are illustrated. In the first handbook, photographs of a large (or "95th percentile") hand wearing an anti-contact glove, a wet-cold mitten insert and shell, a wet-cold fingered glove, and an Arctic mitten insert and mitten set are presented. The photographs show the hand extended flat, closed as a fist, gripping handles of various sizes, and gripping knobs of various sizes. Each photograph includes a scale graduated in both inches and centimeters. The second handbook has a similar format and the same types of handwear were used, with the exception that the hand used in the illustrations is a small (or "5th percentile") hand. These two handbooks thus present photographs from which dimensions of a large and a small gloved hand may be scaled for design purposes.

In another study, White, Kobrick, and Zimmerer (1964)<sup>22</sup> presented anthropometric data on Army men dressed in an Arctic clothing ensemble. The Arctic clothing was utilized since it represented the maximum bulk of the clothed man in terms of the space occupied by the individual. The data are presented in tabular form, giving the body measurements of the nude man, the clothed man, and the difference or increment attributable to the bulky Arctic clothing. Eight hand measurements are included in the data: Hand Length, Palm Length, Hand Breadth, Hand Breadth at Thumb, Hand Circumference, Fist Circumference, 1st Phalanx III Length, and Hand Thickness. Values representative of the 1st and 5th percentiles (or small men), the 50th percentile (or medium men), and the 95th and 99th percentiles (or large men) are given. The data of this report show the maximum increase in hand size when heavy and bulky Arctic mittens are worn — a "worst case" situation.

<sup>20</sup>Kobrick, J.L. Quartermaster Human Engineering Handbook Series: II. Dimensions of the Upper Limit of Gloved Hand Size. Technical Report EP-41, U.S. Army Quartermaster Research and Development Center, Natick, Massachusetts, December 1956. (AD 127 124)

<sup>21</sup>Kobrick, J.L. Quartermaster Human Engineering Handbook Series: III. Dimensions of the Lower Limit of Gloved Hand Size. Technical Report EP-43, U.S. Army Quartermaster Research and Development Center, Natick, Massachusetts, February 1957. (AD 137 961)

<sup>22</sup>White, R.M., J.L. Kobrick, and T.R. Zimmerer. Reference Anthropometry of the Arctic-Equipped Soldier. Technical Report EPT-2, U.S. Army Natick Laboratories, Natick, Massachusetts, August 1964. (AD 449 483)

In another study, Garrett (1968)<sup>23</sup> presented data and illustrations giving clearance and performance values for the bare-handed and the pressure-gloved operator. The report summarizes hand and arm dimensional, clearance, and strength data for 27 U.S. Air Force men wearing the A/P22S-2 full-pressure suits. Thirty-six measurements were taken under each of three conditions: bare-handed, gloved and unpressurized, gloved and pressurized. The data are both summarized for all subjects and reported independently by glove size worn. Also, uses of the data are suggested and specific design values are recommended.

A somewhat different type of research of hands and handwear was reported by Kennedy, Woodbury, and Madnick (1962).<sup>24</sup> This report describes and discusses a process in which master model hands and hand forms were developed. Three pairs of master model hands, designated as sizes small, medium, and large were sculptured. The hands were modeled in a relaxed position, with the palms and fingers in a natural, curved shape. Following this, metal dipping forms and experimental gloves were fabricated. A sizing study was then conducted on a series of 285 men, and it was determined that a high percentage of the male military population could be expected to be properly fitted with four sizes of gloves. Subsequently, porcelain dipping forms also were fabricated. As a result of this work, it was concluded that the measurements of the experimental master model hand forms could be used as the basis of design and sizing for all types of dipped handwear developed by the Quartermaster Corps for use by Army personnel. Fabric lined vinyl coated gloves could be manufactured over dipping forms based on the experimental master model hands which meet the size and design requirements of the Army. Unsupported rubber, or rubber type gloves could be manufactured over porcelain dipping forms designed and developed by the Quartermaster Corps. These forms could be made available to the glove dipping industry for either military or commercial applications.

#### c. U.S. Army Handwear

In spite of a great deal of research and development work and a large amount of effort expended in attempts to improve the sizing and fit of military handwear, the situation today still is far from satisfactory. While the design to be found in the many different types of military handwear generally is good, the sizing of military handwear is not consistent and leaves much to be desired from the standpoint of logistic efficiency.

<sup>23</sup> Garrett, J.W. Clearance and Performance Values for the Bare-Handed and the Pressure-Gloved Operator. Technical Report AMRL-TR-68-24, Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio, August 1968. (AD 681 457)

<sup>24</sup> Kennedy, S.J., R.L. Woodbury, and H. Madnick. Design and Development of Natural Hand Gloves. Clothing and Equipment Development Branch Series Report No. 33, U.S. Army Quartermaster Research and Engineering Center, Natick, Massachusetts, July 1962. (AD A047 962)

The current edition of the Department of the Army Supply Bulletin, entitled Size Tariff for Clothing, Equipage and Footwear (SB 10-523), and dated December 1979 (Reference 14), contains a total of 29 different line items of handwear, including 26 types of gloves and three types of mittens. These standard items of U.S. Army handwear are listed in Table 69, together with the sizing system for each item.

Although the title of the Supply Bulletin would seem to indicate that tariffs are given for the items listed, it is clearly stated that the "size tariffs contained in this bulletin are based on a worldwide demand experience, and are not, therefore, applicable to individual installations." These tariffs, then, merely reflect the sizes and quantities of clothing (and handwear) which have been ordered or requisitioned by Army posts, camps, and stations all over the world. The primary point here is that the "tariffs" given in the Supply Bulletin are not based upon the body sizes or hand sizes of individuals in the Army population. A tariff, in the true sense of the word, should be a listing by size of the numbers or quantities of an item required for the population for which the item is intended, and as such, it should be based upon a correlation between the body sizes of individuals and the available sizes of the item. A tariff for handwear, then, should be based upon the sizes and numbers of hands to be fitted with that handwear.

A further complication found in today's Army, in which there are increasing numbers of women, is that attempts are being made to issue to women items, including handwear, which were originally designed and sized for men. In fact, the current edition of the Supply Bulletin cited above designates all line items of clothing and equipment, including handwear, as intended for "male", "female", or "male and female." In some instances at least, the suitability and sizing of these items for women may be open to question.

Specifically with reference to the 29 standard types of handwear currently available in the U.S. Army inventory, a basic problem of sizing exists. There are at least three different sizing systems for handwear (see Table 69). The first is a system of adjective sizes, in which sizes of gloves or mittens are designated as Small, Medium, and Large, or variations thereof. Some items of handwear are carried in only Medium and Large sizes, some only as Small and Medium, while others may show a range from X-Small to Medium-Large, or again a range including Small, Medium, Large, and X-Large. A second system for the designation of handwear sizes utilizes numerical sizes, such as sizes 1, 2, 3, 4, 5, and perhaps 6. This is believed to be a sizing system limited to military handwear. Yet a third sizing system also uses numerical size designations, but these are 5, 6, 7, 8, 9, 10, 11, or 6, 6½, 7, 7½, 8, 8½, 9, or again 8, 9, 10, 11, 12. This system of sizing probably is derived from the sizing systems utilized for civilian handwear.

Some reasons for this confusion in the sizing systems for handwear may be advanced. Some items of Army handwear are covered by military specifications, in which the sizing system to be used is clearly defined. But as indicated above, these sizing systems may be one type of numerical (from 1 to 5 or 6), another type of numerical (from 5 or 6 to 11 or 12), or adjectival (Small, Medium, Large). On the other hand, some specialized types of handwear which are required for military use are not based upon military research and development

Table 69. U.S. ARMY HANDWEAR (excerpted from SB 10-523)

- 1 GLOVES AND SOCKS SET, Chemical Protective (male and female)  
Sizes: X-Small, Small, Medium-Large
- 2 GLOVES, CLOTH, dress, nylon knit, black, for JROTC (female)  
Sizes: Small, Medium, Large
- 3 GLOVES, CLOTH, dress, nylon knit, white, for JROTC (female)  
Sizes: Small, Medium, Large
- 4 GLOVES, CLOTH, dress, nylon knit, white (female)  
Sizes: 6, 6½, 7, 7½, 8, 8½, 9
- 5 GLOVES, CLOTH, dress cotton knitted, white (male)  
Sizes: Small, Medium, Large
- 6 GLOVES, CLOTH, work type, cotton knit, white (male and female)  
Sizes: Small, Medium
- 7 GLOVES, CLOTH, work type, anti-contact leather palm, brown, shade 105  
(male and female)  
Sizes: Small, Medium, Large
- 8 GLOVES, COMBAT VEHICLE CREWMAN'S, summer (male)  
Sizes: 5, 6, 7, 8, 9, 10, 11
- 9 GLOVES, FLYERS' sage green (male and female)  
Sizes: 7, 8, 9, 10, 11
- 10 GLOVES, leather, dress, black (male)  
Sizes: 8, 9, 10, 11, 12
- 11 GLOVES, leather, dress, sheepskin, black, silk lining (female)  
Sizes: 6, 6½, 7, 7½, 8, 8½, 9
- 12 GLOVES, leather, work type, gauntlet cuff, linesmens', cream or light gray  
(male and female)  
Sizes: Small, Medium, Large, X-Large
- 13 GLOVES, leather, work type, gauntlet cuff, welders', cream or light gray  
(male and female)  
Sizes: Medium, Large
- 14 GLOVES, leather, work type, heavy duty, gauntlet cuff, cream  
(male and female)  
Sizes: 2, 3, 4, 5
- 15 GLOVES, ROCKET FUEL HANDLERS', cotton coated cloth, gauntlet cuff, gray  
(male and female)  
Sizes: Small, Medium, Large, X-Large

Table 69. U.S. ARMY HANDWEAR (continued)

- 16 GLOVES, rubber, natural or synthetic, acid and alkali resistant, black (male and female)  
Sizes: 9, 10, 11, 12
- 17 GLOVES, rubber, natural or synthetic, organic solvent resistant, black (male and female)  
Sizes: 9, 10, 11
- 18 GLOVES, rubber, natural, 3000-volt protection, black (male and female)  
Sizes: 9, 10, 11, 12
- 19 GLOVE INSERTS, FLYERS', rayon knit, brown (male and female)  
Sizes: Small, Medium, Large, X-Large
- 20 GLOVES INSERTS, wool and nylon, OG-208 (male)  
Sizes: 1, 2, 3, 4, 5
- 21 GLOVES SET, Chemical Protective, butyl rubber (male and female)  
Sizes: Small, Medium, Large, X-Large
- 22 GLOVE SHELLS, FLYERS', sheepskin, brown, type HAU-6/P (male and female)  
Sizes: 1, 2, 3, 4, 5, 6
- 23 GLOVE SHELLS, leather, black (male)  
Sizes: 1, 2, 3, 4, 5
- 24 GLOVES, Toxicological Agents Protective, butyl rubber, black (male and female)  
Sizes: X-Small, Small, Medium, Large
- 25 GLOVES, Toxicological Agents Protective, butyl rubber, M-4, black (male and female)  
Sizes: 9, 10, 11, 12
- 26 GLOVES, WIRE MESH, full hand and wrist (male and female)  
Sizes: Small-Left Hand, Medium-Left Hand, Large-Left Hand, X-Large-Left Hand, Small-Right Hand, Medium-Right Hand, Large-Right Hand, X-Large-Right Hand
- 27 MITTEN INSERTS, wool and nylon knit, OG-208, trigger finger (male and female)  
Sizes: Medium, Large
- 28 MITTEN SET, ARCTIC, gauntlet style shell with leather palm (male and female)  
Sizes: Small, Medium, Large
- 29 MITTEN SHELLS, cotton sateen, trigger finger, leather palm and thumb, OG-107 (male and female)  
Sizes: Medium, Large

or are not covered by military specifications, but are merely purchased in the commercial market; these items simply come the way the manufacturer sized them in the first place.

The unfortunate result of this multiplicity of sizing systems in Army handwear is that existing items of handwear virtually defy any logical or coherent analysis for the purpose of assessing fit or for the development of adequate and meaningful tariffs. Thus, it is almost impossible to draw up a table of equivalent sizes for all of the various types of Army handwear.

It is suggested that a fundamental reason for the lack of consistency in the sizing of Army handwear is that in recent years not nearly enough attention has been paid to the utilization and application of the large amounts of anthropometric data which now are available on the hands of U.S. Army personnel, both men and women. This has not always been the case. It is interesting to note that between 1948 and 1959, various types of memorandum reports and research study reports were written for internal use documenting at least ten studies and investigations of Army handwear. All of these studies involved fitting and sizing evaluations of handwear, including anthropometric measurements of the hands.

#### d. The Sizing of Handwear

Civilian or commercial dress gloves usually are sized according to a numerical designation ranging from six to ten in whole and/or half sizes, while work gloves or protective gloves for sports may be designated simply as Small, Medium, or Large. Approximate equivalents for the numerical and adjective sizing systems are: 6-6½ - X-Small, 7-7½ - Small, 8-8½ - Medium, 9-9½ - Large, and 10-10½ - X-Large. But what actually is the basis for the sizing of handwear?

Handwear sizing is based upon the circumference or girth of the hand; that is, the girth of the palm, excluding the thumb. An individual with a hand circumference of 8-8½ inches presumably would take a size 8 or 8½ (or a "medium") glove or mitten.

The lengths of gloves apparently are based upon gradations up and down (or longer and shorter) from a length arbitrarily assigned to a size 8 or 8½ glove. Finger lengths are accommodated by designing the fingers of the glove slightly too short, so that when the glove is placed on the hand, the tips of the fingers will reach the ends of the glove fingers. This method still is not satisfactory, as only one or two of the fingers are properly accommodated. Glove fingers for the thumb and little finger of the hand usually are too long. It would appear that not enough attention has been paid to the relative lengths or proportions of the fingers in standard glove designs, since the normal range of variation in finger lengths usually is not provided for.

Unfortunately, the primary sizing of handwear on the basis of hand circumference is not nearly as simple as it might seem. The fact of the matter is that the basic unit of measurement for glove patterns and glove sizing is not the familiar English inch, but the French inch, also referred to as the Paris inch or glovers' inch. In French, the word "pouce" refers to the thumb; "pouce" also is the word used to indicate an inch.

A standard measuring instrument in the glove trade is a wooden ruler, graduated into twelve French or glovers' inches; each of these units is further divided into twelfths. A simple tape, used in some stores to determine glove size by measuring hand circumference, shows glove sizes from 4 to 10; each of these size increments also is based on the French or glovers' inch.

The so-called French inch is not only not equivalent to the English inch, but there appears to be some confusion as to the actual identity of the French inch. In Severn's book on gloves (Reference 52), there is a list of words having to do with gloves. Included in this list is the following definition (page 167): "zoll — The French glovemaker's rule is divided into twelve zolls, one zoll being slightly longer than one inch (12 zolls equal not quite 13 inches), and each zoll again is divided into twelfths; the zoll ruler, also called a French rule, is an international measuring stick of glove-making." This definition unfortunately does not clarify matters on the French inch, since "zoll" actually is a German word for inch. This word also is used in Switzerland.

While preparing background material for this technical report, an inquiry was directed to the National Association of Glove Manufacturers, Inc., Gloversville, New York, requesting information on the French inch and on the zoll. A reply to this letter included the following information: "The word zoll is, as you have indicated, the word for the German inch. Since the European countries are on the metric system, the German inch and the French inch are both 25.4 mm. The French glovers' rule (sic), however, used exclusively in the glove trade, is one and one sixteenth inches long or approximately 27 mm in length and does not relate to a standard French inch. As far as we could ascertain, the German glove industry used the French rule in their glove production." Unfortunately again, this comment merely adds to the confusion. European countries on the metric system use the centimeter as a basic unit of measurement and there is no such thing as a French or German inch of 25.4 mm — this is the metric value of the English inch. The reference to the French glovers' "rule" obviously was an error; read "inch" for "rule".

In an attempt to clarify this confused situation, a very simple expedient was carried out. A French, Paris, or glovers' rule (of 12 French inches) was measured with a metric tape, and it was found to be equivalent to 325 millimeters. Ten French or glovers' inches equaled 270 millimeters; thus, the French or glovers' inch has a value of 27.0 millimeters. Interestingly enough, this finding was confirmed in a U.S. Air Force technical report (published in 1956; Reference 2, page 9), which states: "One glovers' inch equals 27.0 millimeters or 1.06 English inches."

Since it has been determined that gloves are sized on the basis of hand circumference and that glove size is based on the French or glovers' inch equivalent to 27.0 millimeters, a Size 8 glove then should fit a hand which is 8 x 27.0 or 216 millimeters in circumference. It is an interesting coincidence that the mean or average hand circumference for U.S. Army men is 216.1 millimeters (8.51 inches); thus the average glove size for Army men would be Size 8.

The dimensional equivalents (values of hand circumference) for glove sizes (based on the French or glovers' inch) range from 108.0 millimeters (4.25 inches) for Size 4, to 216.0 millimeters (8.50 inches) for Size 8, up to 324.0 millimeters (12.75 inches) for Size 12.

Minimum hand circumference for U.S. Army men is 178.0 millimeters and maximum hand circumference is 263.0 millimeters; the total range of glove sizes for Army men would be about Size 6½ to Size 10. The 1st percentile value of hand circumference for Army men is 191.2 millimeters, while the 99th percentile value is 244.7 millimeters; this would correspond to a range of glove sizes from about Size 7 to Size 9 for 98 percent of Army men.

The hand sizes of U.S. Army women are relatively smaller than those of Army men. The mean or average hand circumference for U.S. Army women is 184.5 millimeters (7.26 inches); thus, the average glove size for Army women would be about Size 7. Minimum hand circumference for Army women is 158.0 millimeters and maximum hand circumference is 212.0 millimeters; the total range of glove sizes for Army women then would be Size 6 to Size 8. The 1st percentile value for hand circumference for Army women is 165.4 millimeters, while the 99th percentile value is 203.7 millimeters; this would correspond to a range of glove sizes from about Size 6½ to Size 7½ for 98 percent of Army women.

#### e. Tariffs for Handwear

In the development of military clothing, and handwear as well, the initial effort usually is devoted to the selection of the sizes and the size system or range of sizes required for the population to be fitted. An important part of this process is the design and drafting of the patterns over which the clothing or handwear will be made. The list of sizes, as well as the dimensions of the completed items, are incorporated into a military specification which becomes the official document used for the item. If the item is to be made up in large quantities for military use, a contract is negotiated with a qualified manufacturer and a set of the patterns is furnished to the contractor. The final and very important element of information required in this process consists of the determination of the quantity to be fabricated. In other words, "how many"? This designation of the quantities of an item, broken down by size, is called a tariff. The tariff, then, is how many of what sizes are needed.

If no sizing is involved, the tariff is merely the total quantity needed. But if an item is designed in several sizes, the total quantity to be procured must be broken down by size. It is unlikely that equal quantities would be needed or procured for all sizes in the size system. For example, if an item of handwear is designed in three sizes: Small, Medium, and Large, then the tariff for a total quantity of 10,000 pairs of that item might be 25 percent (2,500 pairs) Size Small, 50 percent (5,000 pairs) Size Medium, and 25 percent (2,500 pairs) size Large.

The process by which any such tariff is developed (other than by the use of sheer guesswork) should involve the use of anthropometric data which are representative of the population to be fitted. In the case of handwear, it has been demonstrated that the primary dimension utilized in the sizing of gloves is hand circumference. In developing a tariff for handwear, then, the main question is what is the range and distribution of the hand circumference measurements in the population to be fitted?

A bivariate table is used in the development of a tariff. Thus a tariff for handwear for U.S. Army men would be based upon a bivariate table of hand circumference and hand length for a sample of 6682 U.S. Army men, as shown in Table 24 (in centimeters) or Table 42 (in inches). These tables indicate that the range of hand circumference for U.S. Army men is from 17.0 to 27.0 cm (or 7.0 to 10.5 inches). The range of hand circumference accommodated by a Size 7 glove is approximately 16.0 to 19.0 cm; Size 8 will fit hand circumferences from about 19.0 to 21.5 cm; Size 9 will fit from about 21.5 to 24.0 cm; and Size 10 will fit from about 24.0 to 27.0 cm of hand circumference.

These limits of fit for the various sizes of gloves then are superimposed on a hand circumference/hand length bivariate, as shown in Table 70. The numbers or percentages of men having hand circumferences within these limits are added up to obtain the tariff. The results of this process produces a tariff of gloves for U.S. Army men as follows: Size 7 — 0.8 percent; Size 8 — 45.0 percent; Size 9 — 51.6 percent; and Size 10 — 2.6 percent. In Table 24, it may be noted that 2,259 men (or 33.8 percent) are shown as having hand circumferences between 21.0 and 22.0 cm. Since the upper limit of fit for a Size 8 glove is approximately 21.5 cm, half of these men or 1,130 individuals (16.9 percent) would take Size 8, while the other half of 1,129 men (16.9 percent) would take Size 9.

The correct number of quantity of gloves by size for any total number or quantity of gloves, such as 1,000, 5,000, or 10,000 pairs, may be ascertained through the use of the percentages for each size. Thus a tariff for 10,000 pairs of gloves for U.S. Army men would consist of Size 7 — 0.8 percent or 80 pairs; Size 8 — 45.0 percent or 4,500 pairs; Size 9 — 51.6 percent or 5,160 pairs; and Size 10 — 2.6 percent or 260 pairs.

A similar process would be followed in the derivation of a tariff of gloves intended for U.S. Army women, but with the use of the hand circumference/hand length bivariate for a sample of 1330 Army women, as shown in Table 25 (in centimeters) or Table 43 (in inches). The resulting tariff of gloves for U.S. Army women would be: Size 7 — 71.3 percent and Size 8 — 28.7 percent, as shown in Table 71. The five women whose hand circumferences fall between 21.0 and 22.0 cm probably could wear Size 8, while the one woman whose hand circumference is below 16.0 cm could wear Size 7.

If the data on hand circumference and hand length for both U.S. Army men and women are combined into one bivariate, the result would appear as Table 26 (in centimeters) or Table 44 (in inches). A tariff of gloves which would provide for both men and women would have to accommodate the smallest women's hands and the largest men's hands. It should be noted that the combined sample of 8,012 individuals (Tables 26 and 44) consists of 6,682 men and 1,330 women. Such a combined tariff of gloves for U.S. Army men and women would be: Size 7 — 12.4 percent, Size 8 — 42.3 percent, Size 9 — 43.1 percent, and Size 10 — 2.2 percent, as shown in Table 72. While this tariff is based upon a sample of 8,012 individuals, larger or smaller quantities of handwear could be calculated through the use of the percentages indicated. These tariffs are considered to be close approximations, used here for illustrative purposes. While these tariffs may not be absolutely accurate, they can be considered to be sufficiently accurate for general purposes.

Table 70. TARIFF FOR GLOVES - BASED ON BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH FOR U. S. ARMY MEN (1977)

HAND LENGTH													
Centimeters													
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent
27.0	:	:	:	:	:	:	1	:	2	:	2	1	:
	:	:	:	:	:	:	:	:	:	:	:	:	)
26.0	:	:	:	:	:	:	.0:	.0:	.0:	.0:	.0:	177	)
<u>SIZE 10</u>	:	:	:	1	:	1	8	:	11	:	5	:	)
	:	:	:	:	:	:	:	:	:	:	:	1.77	)
25.0	:	:	:	1	:	23	45	:	49	:	22	3	2
	:	:	:	:	:	:	:	:	:	:	:	2.6	)
24.0	:	:	:	1	:	11	109	:	264	:	187	44	14
	:	:	:	:	:	:	:	:	:	:	:	3	)
<u>SIZE 9</u>	:	:	:	3	:	80	447	:	729	:	382	42	5
	:	:	:	:	:	:	:	:	:	:	:	3451	)
23.0	:	:	:	.0:	1.2:	6.7:	10.9:	5.7:	.6:	.1:	:	51.6	)
<u>SIZE 8</u>	:	:	:	10	:	214	940	:	849	:	215	29	2
	:	:	:	:	:	:	:	:	:	:	:	3006	)
22.0	:	:	:	.1:	3.2:	14.1	12.7:	3.2:	.4:	.0:	:	45.0	)
21.0	:	:	:	36	:	310	728	:	377	:	66	2	:
<u>SIZE 7</u>	:	:	:	:	:	:	:	:	:	:	:	48	)
20.0	:	:	:	.5:	4.6:	10.9:	5.6:	1.0:	.0:	:	:	.8	)
<u>SIZE 6</u>	:	:	:	18	:	115	156	:	65	:	3	1	)
19.0	:	:	2	:	6	:	23	:	15	:	:	:	)
	:	:	:	:	:	:	:	:	:	:	:	6682	)
Totals	:	:	3	74	755	2120	2338	915	147	25	5	100.0%	
Percent	.	.	0	1.1	11.3	36.2	35.0	13.7	2.2	.4	.1		

Table 71. TARIFF FOR GLOVES - BASED ON BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH FOR U. S. ARMY WOMEN (1977)

		HAND LENGTH													
		Centimeters													
		14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent	
H A N D C e n t i m e t e r s	27.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	26.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	25.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	24.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	23.0	:	:	:	:	:	:	:	:	:	:	:	:	:	
	22.0	:	:	:	:	1:	2:	1:	1:	:	:	:	:	:	
	21.0	:	:	:	:	.1:	.2:	.1:	.1:	:	:	:	:	:	
	<u>SIZE 8</u>	:	:	:	2:	9:	22:	17:	2:	:	:	:	381	28.7	
	20.0	:	:	.2:	.7:	1.7:	1.3:	.2:	:	:	:	:	:	949	
	19.0	:	1:	25:	128:	130:	39:	1:	:	:	:	:	:	71.3	
	18.0	:	6:	152:	276:	144:	20:	1:	:	:	:	:	:		
	<u>SIZE 7</u>	:	:	:	:	:	:	:	:	:	:	:			
	17.0	:	.1:	2.3:	11.5:	9.6:	1.3:	.2:	:	:	:	:			
	16.0	:	11:	26:	10:	1:	:	:	:	:	:	:			
	15.0	:	:	.8:	2.0:	.8:	.1:	:	:	:	:	:			
Totals		:	1	48	359	552	286	79	5	:	:	:	1330	100.0%	
Percent		.	.1	3.6	27.0	41.5	21.5	5.9	.4						

Table 72. TARIFF FOR GLOVES - BASED ON BIVARIATE TABLE OF HAND CIRCUMFERENCE AND HAND LENGTH FOR U. S. ARMY MEN AND WOMEN

HAND LENGTH													
Centimeters													
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent
	:	:	:	:	:	:	:	:	:	:	:		
27.0							1	2	2	1	1		
	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:		
26.0							.0	.0	.0	.0	.0		
	:	:	:	:	:	:	:	:	:	:	:		
<u>SIZE 10</u>					1	1	8	11	5			177	
	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	.0	.0	.1	.1	.1				
25.0													2.2
	:	:	:	:	1	23	45	49	22	3	2		
	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	.0	.3	.6	.6	.3	.0	.0		
24.0													
	:	:	:	1	11	109	264	187	44	14	3		
	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	.0	.1	1.4	3.3	2.3	.5	.2	.0		
H	23.0												
A													
N	<u>SIZE 9</u>				3	80	447	729	382	42	5		3453
D					:	:	:	:	:	:	:		
C					.0	1.0	5.6	9.1	4.8	.5	.1		43.1
I	22.0												
R					10	215	942	850	216	29	2		
C					:	:	:	:	:	:	:		
U	21.0				.1	2.7	11.8	10.6	2.7	.4	.0		
M					:	:	:	:	:	:	:		
F	<u>SIZE 8</u>				38	319	750	394	68	2			
E					:	:	:	:	:	:	:		
R	20.0				.5	4.0	9.4	4.9	.8	.0			3385
E					:	:	:	:	:	:	:		
K	19.0				1	43	243	286	104	4	1		42.3
C					:	:	:	:	:	:	:		
E					.0	.5	3.0	3.6	1.3	.0	.0		
18.0					8	158	299	129	20	1			
					:	:	:	:	:	:	:		
					.1	2.0	3.7	1.6	.2	.0			
<u>SIZE 7</u>	1	31	153	128	18	2							997
	:	:	:	:	:	:							
	.0	.4	1.9	1.6	.2	.0							
17.0					11	26	10	1					12.4
	:	:	:	:	:	:	:	:					
	:	:	:		.1	.3	.1	.0					
16.0					1								
	:	:	:		:								
	:	:	:		.0								
15.0													
Totals	1	51	433	1307	2706	2417	920	147	25	5		8012	
Percent	.0	.6	5.4	16.3	33.8	30.2	11.5	1.8	.3	.1		100.0%	

The tariffs for handwear discussed and illustrated above may be refined to a higher degree of accuracy by a further processing of the anthropometric data on hand measurements. This can only be done, however, provided that three essential elements are available. These are: 1) access to a computer, 2) anthropometric data on men's and women's hands which are on file in the computer, and 3) a suitable computer program which will process and sort the stored data, and also provide usable printouts of the results.

In this procedure, the computer is instructed to calculate and print a bivariate table; in this case, the required bivariate table is based on hand circumference and hand length. Essentially, the computer is requested to sort men's and women's hands into categories which correspond exactly to glove sizes. Since hand circumference is the basic hand dimension for the sizing of gloves, hand circumference is the primary controlling hand dimension here.

In the previous tariffs (Tables 70, 71, and 72), hand circumference was sorted in intervals of one centimeter, and the limits of fit for the various glove sizes were estimated in the generation of the tariffs. In the present refinement, the intervals used for hand circumference are 2.7 cm, which is the range of hand circumference covered by each glove size. The computer, then, is instructed to sort hand circumference in intervals of 2.7 cm, beginning with 13.5 cm, which is the lower limit of Size 6 gloves (or the upper limit of Size 5 gloves). This sorting goes up to 27.0 cm, which is the upper limit of Size 10 gloves. The range of hand length used here is the same as before: 14.0 to 24.0 cm, in one centimeter intervals.

The resulting refined tariff of gloves for U.S. Army men is shown in Table 73. This tariff consists of Size 7 - 0.5 percent, Size 8 - 49.5 percent, Size 9 - 48.6 percent, and Size 10 - 1.4 percent. In the previous tariff, Sizes 8 and 9 together had a requirement of 96.6 percent, whereas here Sizes 8 and 9 show a 98.1 percent requirement. Also, it may be seen that, due to the slight shift in total percentages, Size 8 now shows a slightly higher requirement than Size 9, while previously Size 9 was slightly higher than Size 8. Tariffs generally are sensitive to even slight shifts in the limits of fit.

A similar procedure may be followed in a sorting of women's hand data, the results of which are shown in Table 74. As in the previous tariff for women, the requirements for gloves for U.S. Army women are concentrated in Sizes 7 and 8; Size 7 - 68.1 percent and Size 8 - 31.8 percent. However, in the refinement process, the requirement for Size 7 has decreased slightly and the requirement for Size 8 has increased slightly. One woman in the sample is shown as needing a Size 6 glove; although she has a minimum hand circumference of 15.8 cm, she probably could wear a Size 7 glove satisfactorily.

The refinement of a combined tariff of gloves for both U.S. Army men and women shows similar results, as indicated in Table 75. Here the main requirement is for Sizes 8 and 9; Size 8 - 46.5 percent and Size 9 - 40.6 percent. The requirement of almost 12 percent for Size 7 is primarily for women who need the smaller glove size.

The process of tariff refinement may be continued in one more final step. It may be noted that Tables 73, 74, and 75 show tariffs for U.S. Army men, for U.S. Army women,

Table 73. TARIFF FOR GLOVES IN WHOLE SIZES FOR U. S. ARMY MEN (1966)

		HAND LENGTH																		
		Centimeters																		
		14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent						
H A N D C e C n I R C U M F E R E N C E	27.0	:	:	:	:	1	:	12	:	29	:	32	:	18	:	2	:	2	:	96
	<u>SIZE 10</u>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	24.3	:	:	:	4	:	144	:	892	:	1365	:	707	:	111	:	23	:	3	3249
	<u>SIZE 9</u>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	21.6	:	:	:	.1	:	2.2	:	13.3	:	20.4	:	10.6	:	1.7	:	.3	:	.0	48.6
	<u>SIZE 8</u>	:	:	:	:	66	:	594	:	1504	:	944	:	176	:	18	:	:	:	3302
	18.9	:	:	:	1.0	:	8.9	:	22.5	:	14.1	:	2.6	:	.3	:	:	:		49.5
	<u>SIZE 7</u>	:	:	:	3	:	4	:	16	:	12	:	:	:	:	:	:	:		35
	16.2	:	:	:	.0	:	.1	:	.2	:	.2	:	:	:	:	:	:	:		.5
	<u>SIZE 6</u>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	13.5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Totals		3	74	755	2420	2338	915	147	25	5		6682							
	Percent		.0	1.1	11.3	36.2	35.0	13.7	2.2	.4	.1			100.0%						

Table 74. TARIFF FOR GLOVES IN WHOLE SIZES FOR U. S. ARMY WOMEN (1977)

HAND LENGTH													Totals	Percent	
Centimeters															
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0				
	:	:	:	:	:	:	:	:	:	:	:				
	27.0	—													
H	<u>SIZE 10</u>	:	:	:	:	:	:	:	:	:	:				
A		:	:	:	:	:	:	:	:	:	:				
N	<u>24.3</u>	—													
D	<u>SIZE 9</u>	:	:	:	:	:	:	:	:	:	:				
C		:	:	:	:	:	:	:	:	:	:				
C	<u>21.6</u>	—													
I	<u>SIZE 8</u>	:	:	2	:	33	:	157	:	168	:	59	:	4	
R		:	:	:	:	:	:	:	:	:	:	:	:	423	
C	<u>SIZE 7</u>	:	:	:	:	:	:	:	:	:	:			31.8	
U		:	:	.2	:	2.5	:	11.8	:	12.6	:	4.4	:	.3	
M	<u>18.9</u>	—													
F	<u>SIZE 6</u>	:	1	:	46	:	325	:	395	:	118	:	20	:	1
E		:	:	:	:	:	:	:	:	:	:			906	
R		:	.1	:	3.5	:	24.4	:	29.7	:	8.9	:	1.5	:	.1
E	<u>16.2</u>	—												68.1	
N	<u>SIZE 5</u>	:	:	:	1	:	:	:	:	:	:	:	:	1	
C		:	:	:	:	:	:	:	:	:	:			.1	
E	<u>13.5</u>	—													
	Totals	:	1	:	48	:	359	:	552	:	286	:	79	:	5
	Percent	.	1		3.6		27.0		41.5		21.5		5.9		.4
														100.0%	

Table 75. TARIFF FOR GLOVES IN WHOLE SIZES FOR U. S. ARMY MEN AND WOMEN

		HAND LENGTH																			
		Centimeters																			
		14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent							
H A N D C e n t R C U M F E R E N C E	27.0	:	:	:	:	1	:	12	:	29	:	32	:	18	:	2	:	2	:	96	
	<u>SIZE 10</u>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:			
	24.3	:	:	:	:	.0	:	.1	:	.4	:	.4	:	.2	:	.0	:	.0		1.2	
	<u>SIZE 9</u>	:	:	:	4	:	144	:	892	:	1365	:	707	:	111	:	23	:	3		3249
	21.6	:	:	:	.0	:	1.8	:	11.1	:	17.0	:	8.8	:	1.4	:	.3	:	.0		40.6
	<u>SIZE 8</u>	:	:	2	:	99	:	751	:	1672	:	1003	:	180	:	18	:	:	:		3725
	18.9	:	1	:	49	:	329	:	411	:	130	:	20	:	1	:	:	:	:		941
	<u>SIZE 7</u>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:			
	16.2	:	.0	:	.6	:	4.1	:	5.1	:	1.6	:	.2	:	.0	:	:	:		11.7	
	<u>SIZE 6</u>	:	:	:	:	.0	:	:	:	:	:	:	:	:	:	:	:	:		.0	
	13.5	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:			
	Totals	1	51	433	1307	2706	2417	920	147	25	5	8012									
	Percent	.0	.6	5.4	16.3	33.8	30.2	11.5	1.8	.3	.1									100.0%	

and for combined men and women for gloves in whole or even sizes (Sizes 6, 7, 8, 9, 10). If desired, it is perfectly feasible to generate tariffs for gloves in both whole and half sizes. This is accomplished by reducing the intervals for the sorting of hand circumference from 2.7 cm down to 1.35 cm, since 1.35 cm is the range of hand circumference accommodated by each half size of glove.

In this further tariff refinement, the computer merely is instructed to sort men's and women's hands into categories of whole and half glove sizes. The resulting tariffs are shown in Table 76 for U.S. Army men, Table 77 for U.S. Army Women, and Table 78 for both men and women. The range of glove sizes in these tariffs covers Sizes 6, 6½, 7, 7½, 8, 8½, 9, 9½ and 10.

The primary advantage of the tariff refinement process discussed and illustrated above is that the percentage requirement for any glove size (or half size) may be determined at a glance, since the intervals used for sorting hand circumference correspond directly to glove sizes. Also, the spread or range of hand length (or finger length) may be quickly ascertained for any glove size.

Table 76. TARIFF FOR GLOVES IN WHOLE AND HALF SIZES  
FOR U. S. ARMY MEN (1966)

HAND LENGTH												Totals	Percent		
Centimeters															
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0				
	:	:	:	:	:	:	:	:	:	:	:				
27.00															
<u>SIZE 10</u>	:	:	:	:	:	:		2	3	2	1	:	8		
25.65													.1		
<u>SIZE 9½</u>	:	:	:	:	1	12	27	29	16	1	2	:	88		
24.30													1.3		
<u>SIZE 9</u>	:	:	:	1	12	121	289	217	55	16	3	:	714		
22.95													10.7		
<u>SIZE 8½</u>	:	:	3	132	771	1076	490	56	7	:		2535			
21.60													37.9		
<u>SIZE 8</u>	:	:	30	397	1179	824	165	16	:	:		2611			
20.25													39.2		
<u>SIZE 7½</u>	:	:	36	197	325	120	11	2	:	:		691			
18.90													10.3		
<u>SIZE 7</u>	:	3	4	16	12	:	:	:	:	:		35			
17.55													.5		
<u>SIZE 6½</u>	:	:	0	1	2	2	:	:	:	:					
16.20															
<u>SIZE 6</u>	:	:	:	:	:	:		:	:	:					
14.85															
Totals	:	:	3	74	755	2420	2338	915	147	25	5	6682			
Percent	.	0	1.1	11.3	36.2	35.0	13.7	2.2	.4	.1		100.0%			

Table 77. TARIFF FOR GLOVES IN WHOLE AND HALF SIZES  
FOR U. S. ARMY WOMEN (1977)

HAND LENGTH												Totals	Percent		
Centimeters															
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0				
27.00	:	:	:	:	:	:	:	:	:	:	:	1330			
<u>SIZE 10</u>	:	:	:	:	:	:	:	:	:	:	:				
25.65	:	:	:	:	:	:	:	:	:	:	:				
<u>SIZE 9½</u>	:	:	:	:	:	:	:	:	:	:	:				
24.30	:	:	:	:	:	:	:	:	:	:	:				
<u>SIZE 9</u>	:	:	:	:	:	:	:	:	:	:	:				
22.95	:	:	:	:	:	:	:	:	:	:	:				
<u>SIZE 8½</u>	:	:	:	:	:	:	:	:	:	:	:				
21.60	:	:	:	:	4	7	9	1	:	:	:	21			
<u>SIZE 8</u>	:	:	:	:	:	:	:	:	:	:	:		1.6		
20.25	:	:	2	33	153	161	50	3	:	:	:	402			
<u>SIZE 7½</u>	:	:	:	:	:	:	:	:	:	:	:				
18.90	:	:	17	219	334	111	20	1	:	:	:	702			
<u>SIZE 7</u>	:	:	:	:	:	:	:	:	:	:	:				
17.55	:	1	29	106	61	7	:	:	:	:	:	204			
<u>SIZE 6½</u>	:	:	:	:	:	:	:	:	:	:	:				
16.20	:	.1	2.2	8.0	4.6	.5	:	:	:	:	:	15.3			
<u>SIZE 6</u>	:	:	:	:	:	:	:	:	:	:	:	1			
14.85	:	:	:	.1	:	:	:	:	:	:	:		.1		
Totals		1	48	359	552	286	79	5	:	:	:	1330			
Percent		.1	3.6	27.0	41.5	21.5	5.9	.4				100.0%			

Table 78. TARIFF FOR GLOVES IN WHOLE AND HALF SIZES  
FOR U. S. ARMY MEN AND WOMEN

HAND LENGTH													
Centimeters													
	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	Totals	Percent
	:	:	:	:	:	:	:	:	:	:	:	:	:
	27.00												
	SIZE 10	:	:	:	:	:	2	3	2	1	:	8	
		:	:	:	:	:	:	:	:	:	:		
	25.65						.0	.0	.0	.0	:	.1	
	SIZE 9½	:	:	:	:	1	12	27	29	16	1	2	88
		:	:	:	:	:	:	:	:	:	:		
	24.30					.0	.1	.3	.4	.2	.0	.0	1.1
H	SIZE 9	:	:	:	1	12	121	289	217	55	16	3	714
A		:	:	:	:	:	:	:	:	:	:	:	
N	22.95				.0	.1	1.5	3.6	2.7	.7	.2	.0	8.9
D	SIZE 8½	:	:	:	3	132	771	1076	490	56	7	:	2535
C		:	:	:	:	:	:	:	:	:	:		
C	21.60				.0	1.6	9.6	13.4	6.1	.7	.1	:	31.6
I	SIZE 8	:	:	:	30	401	1186	833	166	16	:	:	2632
R		:	:	:	:	:	:	:	:	:			
C	20.25				.4	5.0	14.8	10.4	2.1	.2	:	:	33.0
U	SIZE 7½	:	:	:	2	69	350	486	170	14	2	:	1093
E		:	:	:	:	:	:	:	:	:			
R	18.90				.0	.9	4.4	6.1	2.1	.2	.0	:	13.6
E	SIZE 7	:	:	:	20	223	350	123	20	1	:	:	737
C		:	:	:	:	:	:	:	:	:			
E	17.55				.2	2.8	4.4	1.5	.2	.0	:	:	9.2
S	SIZE 6½	:	:	1	29	106	61	7	:	:	:	:	204
I		:	:	:	:	:	:	:	:	:			
Z	16.20			.0	.4	1.3	.8	.1	:	:	:	:	2.5
S	SIZE 6	:	:	:	1	:	:	:	:	:	:	:	1
		:	:	:	:	:	:	:	:	:			
	14.85				.0	:	:	:	:	:	:	:	.0
	Totals	:	1	51	433	1307	2706	2417	920	147	25	5	8012
	Percent	.	0	.6	5.4	16.3	33.8	30.2	11.5	1.8	.3	.1	100.0%

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